

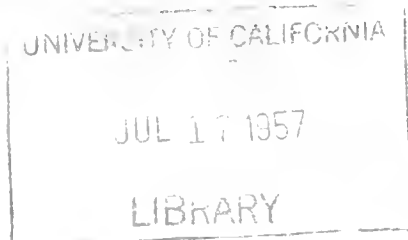
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BULLETIN NO. 59

INVESTIGATION OF UPPER FEATHER RIVER BASIN DEVELOPMENT

INTERIM REPORT ON ENGINEERING, ECONOMIC,
AND FINANCIAL FEASIBILITY OF INITIAL UNITS



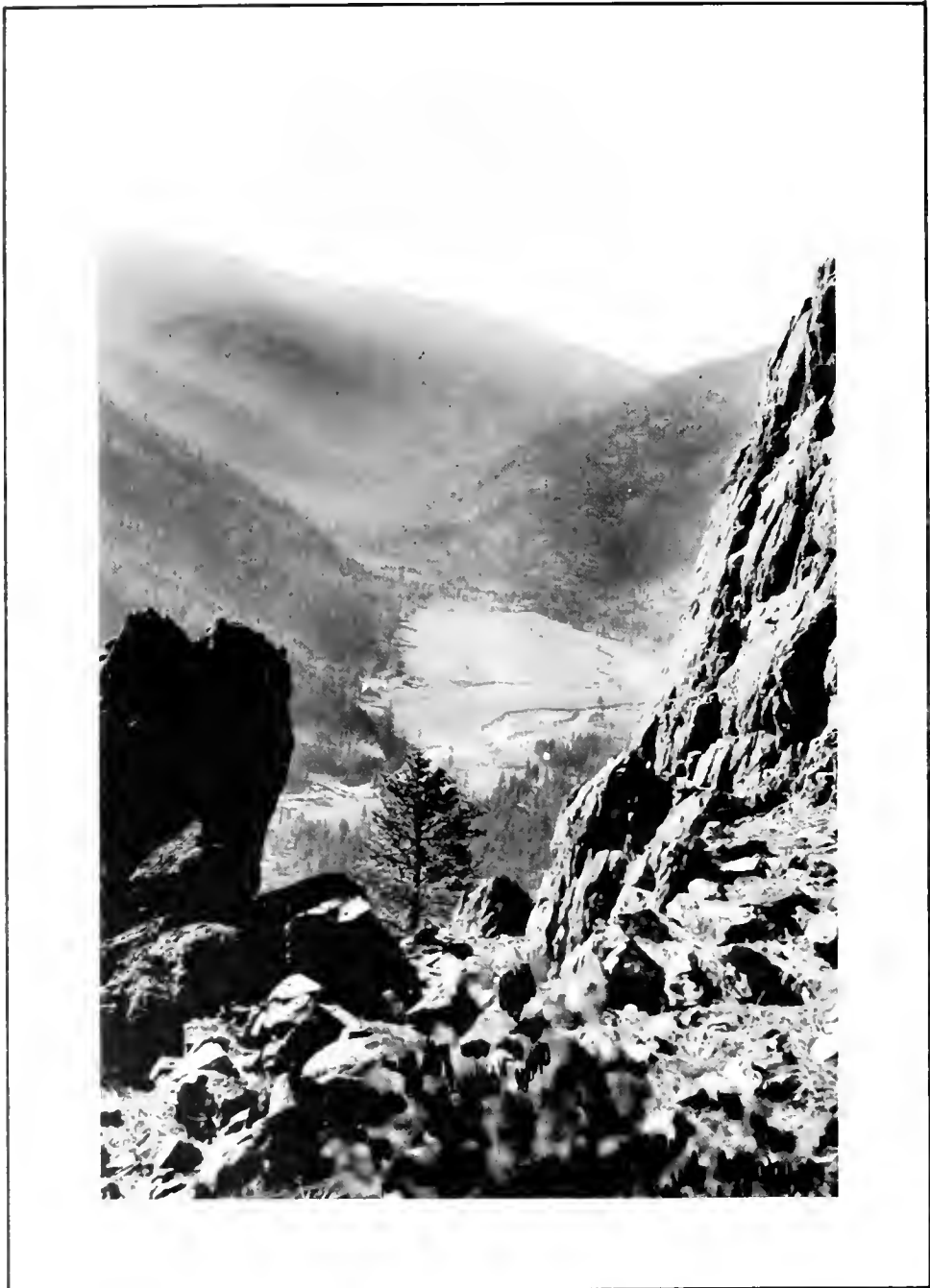
GOODWIN J. KNIGHT
Governor



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Director of Water Resources

February, 1957

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Indian Creek Recreation Area

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
DIVISION OF RESOURCES PLANNING

BULLETIN NO. 59

INVESTIGATION OF UPPER FEATHER RIVER BASIN DEVELOPMENT

INTERIM REPORT ON ENGINEERING, ECONOMIC, AND FINANCIAL FEASIBILITY OF INITIAL UNITS



February, 1957

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Governor

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Director of Water Resources

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STATE OF CALIFORNIA
Department of Water Resources
SACRAMENTO

February 1, 1957

Honorable Goodwin J. Knight, Governor, and
Members of the Legislature of the
State of California

Gentlemen:

There is transmitted herewith Bulletin No. 59 of the Department of Water Resources, entitled "Investigation of Upper Feather River Basin Development, Interim Report on Engineering, Economic, and Financial Feasibility of Initial Units". This is a report of the investigation conducted as authorized by the Legislature in Item 223.1 of the Budget Act of 1956.

Bulletin No. 59 contains results of studies showing that the Frenchman Project, the Grizzly Valley Project, and the Indian Creek Recreation Project are engineeringly feasible and economically justified. Based upon the assumptions made in the report as to financing, policy for which has not been established by the Legislature, the projects would be financially feasible.

Recommendations are included, with certain qualifications, for the appropriation of funds to be expended on these projects to complete the acquisition of lands, easements, and rights of way, prepare construction plans and specifications, and relocate public utilities.

Very truly yours,

A handwritten signature in cursive script, reading "Harvey O. Banks".

HARVEY O. BANKS
Director

ACKNOWLEDGMENT

Valuable assistance and data used in this investigation were contributed by agencies of the State and Federal Governments, Plumas County, public districts, and by private companies and individuals. This cooperation is gratefully acknowledged.

Special mention is also made of the helpful cooperation of the State Department of Fish and Game, State Division of Beaches and Parks, Plumas County Water Resources Board, Plumas County Board of Supervisors, Plumas County Chamber of Commerce, Last Chance Creek Water District, and E. B. Bond, Agricultural Commissioner, and Alton Young, Farm Advisor, both of Plumas and Sierra Counties.

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CHAPTER I. INTRODUCTION

In April, 1955, the Division of Water Resources issued a report entitled "Report on Upper Feather River Service Area". As a result of the findings of this report and subsequent legislative hearings on the subject, the 1956 Session of the California Legislature included as Item 223.1 the following appropriation.

For completion of engineering and geological investigations, studies, and reports with recommendations for a construction program for multipurpose water development and flood control projects in the Upper Feather River Service Area, Division of Water Resources, Department of Public Works ... \$385,000.

The Department of Water Resources, as successor to the Division of Water Resources, has had the responsibility of carrying out the intent of this legislation.

The Upper Feather River Service Area, as defined in the April, 1955, report, encompassed the drainage area of the Feather River above Oroville Reservoir, together with those adjacent lands whose most apparent source of supplemental water supply is from the Feather River system above Oroville Reservoir. The service area boundary is shown on Plate 2, entitled "Proposed Projects". However, since development plans for the waters of the South Fork of the Feather River are presently the subject of negotiations among several parties, including the State of California, the South Fork area was excluded from the present investigations. Accordingly, the studies covered the drainage areas of the North and Middle Forks of the Feather River above Oroville Reservoir. This area embraces some 2,160,000 acres, most of which is in Plumas County, but also includes substantial acreages in Sierra, Lassen, and Butte Counties.

Principal present uses of water within the Upper Feather River Service Area are for irrigation, urban, and recreational

purposes, and for the production of hydroelectric energy. Some industrial uses exist. The 1955 report presented the results of extensive studies of present and possible ultimate land and water uses, which indicated that potential development within the area might require four times as much water as is presently being used. The same report also set forth several possible methods of developing the water resources of the region, together with preliminary cost estimates of these projects.

Objectives of Present Investigations

The present studies are the next logical step in the development of plans for optimum use of the water resources of the Upper Feather River Basin. The basic objectives of these investigations are to:

1. Obtain additional engineering and geological data required for the preparation of detailed cost estimates of projects. These estimates must be of a reliability such that they can be used as a basis for project financing. This in turn requires that the design of structures and facilities be in greater detail than in the April, 1955, report, but not in as much detail as required for construction drawings.
2. Develop the most economical plan for each project.
3. Determine the types and extent of the benefits to be obtained from each project.
4. Make an economic analysis of the benefits and costs of each project to determine economic justification.
5. Allocate the costs of each project equitably among the purposes served to determine financial feasibility.
6. Recommend a program of construction for those projects that are found feasible.

Scope of Report

In July, 1956, geologic investigations and mapping operations were initiated at dam sites in the uppermost portion of the

basin. Because of time limitations, efforts were primarily concentrated on those projects previously recommended for inclusion in the Feather River Project, as set forth in the Division of Water Resources report, "Program for Financing and Constructing the Feather River Project as the Initial Unit of The California Water Plan", dated February, 1955. These dams and reservoirs have been designated as the initial units of the Upper Feather River Basin Development. They include the Antelope Valley, Dixie Refuge, and Abbey Bridge Dams and Reservoirs, which have been designated collectively the "Indian Creek Recreation Project". The initial units also include Frenchman Reservoir, which would provide supplemental irrigation water to the Last Chance Creek service area, and which has been designated the "Frenchman Project". The remaining initial unit is the Grizzly Valley Project, which could be operated primarily to provide an irrigation water supply to Sierra Valley, or could, as an alternative, be operated to provide water to enhance the recreational potential of the Middle Fork of the Feather River. All of the initial projects would provide at-site settings for recreational development. A limited amount of incidental flood control would result from construction of the dams, and all of the reservoirs would, to a limited degree, regulate the flows entering the authorized Oroville Reservoir.

This report presents the results of studies to determine the engineering feasibility, economic justification, and financial feasibility of the initial projects mentioned. It also includes recommendations concerning the additional funds necessary to initiate a program of design and construction for the projects found feasible and justified in the Upper Feather River Service Area.

CHAPTER II. PLANNING CONSIDERATIONS

The "Report on Upper Feather River Service Area", submitted in April, 1955, provided a basis for developing plans for optimum use of water in the basin. However, considerable additional engineering, geologic, and economic work was required before complete engineering and economic analyses could be made. Likewise, proper planning required that consideration be given to the effects of the initial projects on existing and proposed future works on the North and Middle Forks of the Feather River. These subjects are considered and evaluated under the general headings, "Investigations and Design Procedures", "Water Project Evaluation", "Effects of Upstream Reservoirs on Operation of Oroville Reservoir", and "State Water Rights and Federal Power Permits".

INVESTIGATIONS AND DESIGN PROCEDURES

Following is a brief statement of the work that was done, and the general criteria that were applied to all projects for each of the major aspects of the planning program. Greater detail is contained in office reports retained in the files of the Department of Water Resources.

Water Supply

Runoff from the upper drainage basins of the Feather River is derived largely from melting snow, with the major portion of the seasonal runoff occurring during the late spring and early summer months. By late summer and early fall, these streams have reached their seasonal minimum and are sustained only by springs and areas of effluent seepage. The resulting seasonal runoff pattern is one

of concentrated winter and spring floods and meager summer flows. In addition to these intraseasonal cyclic fluctuations, runoff varies from season to season, dependent upon the amount of seasonal precipitation.

The water supply available for development by each project was estimated by natural flow correlations between records of stream flow at the dam sites, when available, and records of comparable nearby streams having records for the desired period. Separate correlations were made for each month of the year in order to establish the strongest estimate possible for the intraseasonal variation, and to make maximum use of the limited data. Impaired flows under project conditions were computed by correcting the estimated natural flows by the consumptive requirements of upstream lands having present water rights. The reservoirs proposed in this report would provide the necessary storage capacity to equalize irregularities in natural flow so that water would be available for use at the times and in the quantities which would allow its most effective utilization. Operation studies were made to determine this dependable quantity of flow. The period of operation chosen was October, 1911 through September, 1956.

Operation studies for storage reservoirs providing supplemental water for irrigation were made on a monthly basis, allowing a maximum deficiency of 50 per cent of the firm yield in one year of the 45-year operation period. Recent experiences in this area as well as other irrigated areas producing similar crops have indicated that a substantial water supply deficiency on rare occasions can be withstood without serious damage to either the crops or the economy of the area. Recreation reservoirs were also

operated on a monthly basis but without a deficiency allowance. Storage-development curves were derived using a graphical mass curve technique, for which water supply and demand were expressed as accumulated departure from mean seasonal water supply. Yields from reservoirs were corrected for evaporation. It was estimated that sedimentation in the reservoirs would cause no appreciable loss in yield during the 50-year life of the projects, because of the low annual sedimentation rate and the relatively large amount of dead storage space recommended. Losses to hydrophytes in and adjacent to the reservoirs is expected to be small because of the water surface fluctuations.

Spillway design flood hydrographs were developed from a regional study of flood frequencies and unit hydrographs. The once-in-a-thousand-year flood was selected as the design flood. The inflow hydrograph was then routed through the reservoir of study to determine the resultant surcharge storage and spillway discharge during critical conditions. Table 1 presents the resultant critical flood discharges for each reservoir, and Table 2 the pertinent water supply data for the projects.

TABLE 1
DESIGN FLOOD INFLOWS TO AND DISCHARGES
FROM RESERVOIRS OF INITIAL UNITS OF
UPPER FEATHER RIVER BASIN DEVELOPMENT

(In second-feet)

Reservoir	: Estimated : peak inflow	: Computed spill- : way discharge
Frenchman	9,800	5,700
Grizzly Valley	10,300	3,100
Abbey Bridge	10,500	7,800
Antelope Valley	9,100	3,400
Dixie Refuge	4,900	2,300

TABLE 2

WATER SUPPLY AVAILABLE TO INITIAL UNITS OF
UPPER FEATHER RIVER BASIN DEVELOPMENT

Item	Dam and reservoir	Stream	Seasonal inflow, in acre-feet	Critical period	Average seasonal inflow during critical period, in acre-feet	New seasonal yield	
						In	Minimum flows, in second-feet
Frenchman Project	Frenchman	Little Last Chance Creek	27,000	1928-1935	15,500	12,000	
Grizzly Valley Project	Grizzly Valley	Big Grizzly Creek	25,000	1923-1935	17,600	14,900	
Alternative Grizzly Valley Recreation Project	Grizzly Valley	Big Grizzly Creek	25,000	1923-1935	17,600		50
Indian Creek Recrea- tion Project	(Abbey Bridge	Red Clover Creek	24,000	1923-1925	11,900		12
	(Antelope Valley	Indian Creek	20,900	1923-1925	11,900		6
	(Dixie Refuge	Last Chance Creek	13,000	1930-1935	7,500		8

Water Requirements

Demands for water from the projects studied herein are for the irrigation of agricultural lands, and for the maintenance of stream flow for fishing and recreational purposes. Another type of demand involves limitation on reservoir fluctuations in order to enhance at-site recreational values. Reservoir operation for this purpose reduces the amount of water available for other uses, and hence must be considered as a water demand. Irrigation requirements were based on results of previous studies by the Division of Water Resources in Sierra and Indian Valleys. Earlier determinations of stream flow maintenance requirements were re-evaluated in light of additional data and surveys by personnel of the Department of Fish and Game.

Irrigation Requirements

Water requirements for agricultural lands in Sierra and Indian Valleys were estimated by multiplying the acreage of each type of projected land use by its respective unit value of consumptive use of applied water. Although present irrigation practices indicate that the individual farm application is about twice the consumptive use, systematic re-use of the water as it passes through the service area makes possible an efficiency of about 75 per cent in Sierra Valley and about 60 per cent in Indian Valley. Based on these data, the seasonal irrigation requirement was estimated to be 2.4 acre-feet per acre in Sierra Valley and 3.0 acre-feet in Indian Valley. The estimated average monthly distribution of demand for irrigation water, measured in terms of per cent of seasonal total, was as follows: May, 3 per cent; June, 21 per cent;

July, 34 per cent; August, 30 per cent; and September, 12 per cent.

Recreation Requirements

Construction of reservoirs in the Upper Feather River Basin would increase the opportunities for stream fishing, camping, picnicking, and watersports such as swimming, boating, and water skiing. In addition to increasing the opportunities for these activities, the construction of reservoirs would markedly improve the scenic value of the area.

Criteria for stream flow maintenance were based upon considerations of streamside recreation as well as the improvement of angling conditions. Optimum stream flow would cover riffles and bars sufficiently to provide food and shelter for fish, maintain a suitable velocity, and provide an attractive setting for streamside recreationists.

The allowable depletion of recreation reservoir storage for stream flow maintenance purposes was also influenced by the effect of fluctuation on the recreational potential of the reservoir and its peripheral area. Consideration was given to such factors as water surface fluctuation and area, minimum depth of water, and shore line location.

The estimated average monthly demands for stream flow maintenance were computed on a continuous flow basis. The year was divided into two parts: the recreation use season, May through October; and the nonuse season, November through April. Flows for the nonuse season were taken as one-half those for the recreation use season.

Surveys and Maps

Topographic maps of the reservoir areas and dam sites of Abbey Bridge, Dixie Refuge, and Antelope Valley, as well as the dam sites of Frenchman and Grizzly Valley, were obtained by aerial photogrammetric methods. This work was done in the fall of 1956 by a commercial firm under contract to the Department of Water Resources. Reservoir maps were produced at a scale of 1 inch equals 400 feet, with a contour interval of 10 feet. Dam site maps were made at a scale of 1 inch equals 100 feet, with a contour interval of 5 feet. Topographic maps of Frenchman and Grizzly Valley reservoir areas were furnished by the United States Bureau of Reclamation. These maps were produced by photogrammetric methods in 1946, at a scale of 1 inch equals 400 feet, with a contour interval of 10 feet.

A route survey of a major portion of a preliminary canal location for the Grizzly Valley Project, from the pond at Walton's Grizzly Lodge to the service area in Sierra Valley, was conducted by plane table methods during the course of this investigation.

Other maps utilized were United States Geological Survey quadrangles, at a scale of 1:62,500, with a contour interval of 40 feet, and Plumas County Assessor's property ownership maps.

Geological Exploration

Geological exploration for each of the proposed dams was divided into two phases--foundation exploration of the dam site, and exploration for suitable construction materials.

Foundation Exploration

The surface geologic features at each dam site were studied and mapped. The types of bedrock, degree of weathering, patterns of jointing, shear zones, and their effects on dam design and stability were studied. The subsurface geologic conditions were investigated by exploratory drilling using diamond bits with an Nx core barrel. The cores obtained from the bedrock were logged, noting rock types, weathering, jointing, etc. The possibility of leakage through the bedrock under each proposed dam was tested by injecting water under pressure into sealed portions of the drill holes and measuring the amount of water lost into the joints and shear zones. Some additional subsurface geologic information was made available at two of the sites by using a bulldozer to strip off some of the overburden.

At the Frenchman dam site, five diamond drill core holes, totaling 410.9 feet, were completed by a contractor. By using a bulldozer, the formation underlying a saddle in the left abutment was exposed for study. At the Grizzly Valley dam site, 12 exploratory holes, totaling 743.7 feet, were completed. Four of the holes were drilled by a contractor, and the remainder by Department equipment. Eight holes with a total footage of 194.8 feet were completed at the Dixie Refuge dam site. A bulldozer was utilized in exploring the abutment slopes at that site. Six holes, totaling 174.6 feet, were drilled at the Antelope Valley dam site, and four holes, totaling 108.4 feet, were completed at the Abbey Bridge dam site before heavy snow necessitated the withdrawal of Department drilling equipment.

Exploration for Construction Materials

This phase of the investigation was begun with a reconnaissance of the area around each dam site to prospect for suitable borrow materials. A preliminary field classification of the materials was made, and the potential borrow areas were outlined on topographic maps. Depths of the deposits were measured in erosion cuts and by drilling test holes. Samples of the various materials were obtained by pick and shovel, hand auger, or power-driven flight auger; the method used being determined by terrain and accessibility. The samples were tested by the Hydraulic Engineering Laboratory of the Department to determine suitability of the various materials for use in dam construction.

Tests of various types were conducted on 52 of the soil samples collected in the field. During exploration for borrow, 50 holes were drilled with a total footage of approximately 900 feet.

Design and Cost of Structures

Extensive field investigations and detailed office analyses were the bases for the design and estimates of cost of structures proposed as features of the various projects. The designs and estimates are believed to be of a reliability such that project financing can be based upon the costs derived, although they are not of a detail suitable for construction plans and specifications.

Designs

All structures were designed in accordance with standard engineering principles, with the objective of obtaining the most economical combination of dam embankment, spillway, and outlet works. The dams were designed to be constructed of available

natural material, with adequate consideration being given to foundation conditions. Stability characteristics of the embankments were based on laboratory tests of sampled material. Spillways were sized to pass the design flood when routed through the reservoir, using surcharge storage above the spillway crest to reduce the peak inflow.

The service canal from Big Grizzly Creek to Sierra Valley was designed so that the hydraulic grade line would be in natural ground. Various types of lining were considered, and the most economical was chosen.

Cost Estimates

Capital costs of dams, diversion works, conduits, and appurtenances were based on quantities estimated from design data. Unit prices of items were determined from recent bid data on similar projects and from manufacturers' cost items, and are considered representative of prices prevailing in the fall of 1956. The estimates of capital cost include: interest during the construction period at 3 per cent per annum; costs of geologic investigation, administration, engineering, and supervision during construction, which would amount to 15 per cent of the field cost of dams and appurtenances and 10 per cent of the field costs of canals; and an allowance of 15 per cent of all field costs to cover contingencies.

WATER PROJECT EVALUATION

Great competition exists for the investment of both public and private funds in the development of the many facets of our national economy. The public interest demands that the available funds be applied in such a manner as to bring maximum returns for

the moneys, resources, and energies expended. This requirement can be met only by a critical evaluation of each proposed project. A proper evaluation of any project requires balanced consideration of (1) an economic appraisal of those benefits and costs which are reasonably measurable in monetary terms, and (2) all values not measurable in monetary terms.

A detailed discussion of the principles and procedures of water project evaluation is beyond the scope of this report. A more extensive explanation is contained in the report dated November 9, 1956, entitled "Views of the California Department of Water Resources on United States Senate Resolution 281, 84th Congress, 2nd Session". Where applicable, the principles set forth in that report have been followed in these studies.

General Criteria

A proposed water project should satisfy at least the requirements of (1) engineering feasibility, (2) economic justification, and (3) financial feasibility.

A project meets the test of engineering feasibility if:

1. It can be built with available materials and techniques, and at a reasonable cost.

2. Sites for the dam, reservoir, and other facilities are geologically suitable.

3. The proposed structures are sound and functionally sufficient.

4. The water supply is adequate in quantity and quality.

5. The soil and climate are suitable for irrigated agriculture, when this is a project function.

6. It makes the best use of the natural environment.

7. It is the best of the known possible alternatives.

8. It permits maximum use of the available water and other natural resources.

9. Future opportunities for development have been considered.

Some of these criteria must be initially considered in a rather broad sense, further refinement being made during the final design stages.

A project may be considered economically justified if the benefits to ensue therefrom can be demonstrated to be in excess of the costs to be incurred in its design, construction, and operation. A comparison of these benefits and costs, commonly known as a benefit-cost analysis, and expressed in terms of a benefit-cost ratio, is usually the best single criterion for the comparison of two or more projects. It is not the sole criterion, however, for such a ratio cannot adequately reflect many intangible benefits and/or detriments which may be of substantial significance in some cases.

For a project to be financially feasible, it must be demonstrated that there is reasonable assurance that the necessary funds to finance the project can be obtained. This means that taxpayers must be able to pay those costs that are considered to be legitimately in the province of the public interest, and that the water users must be able to repay costs considered to be contributed to their direct personal economic gain.

In addition to these criteria there is another important requirement that must ultimately be met. The people must be willing to pay the costs. Unless there is adequate support for the project, it may fail before, during, or after construction. The determination of this item rests with the water users and with the responsible governmental bodies involved. However, some thought

must be given to willingness to pay in the determination of financial feasibility.

All projects described in this report have been evaluated from a broad public viewpoint, and in accordance with the first three criteria just discussed. All projects have been found to be physically feasible. Only those that have been demonstrated to be economically justified and financially feasible are recommended for construction.

Economic Justification

Economic justification was based on the requirements that project benefits exceed project costs, and that each separable segment or purpose of a multipurpose project provide benefits at least equal to its costs. In making the justification analyses only tangible primary benefits were used. A tangible benefit is one that can be adequately expressed in monetary terms, whereas an intangible benefit, although real, cannot be so measured. A primary benefit is the net gain or value realized directly from the project. A secondary benefit is the net gain or value added, over and above the values of the primary benefit, due to processing or other activities that enhance the value of the original product or benefits. In the final selection of projects, consideration was also given to secondary and intangible benefits.

Benefits of the proposed projects accrue primarily from new irrigation supplies, flood control, and new recreation opportunities. These will be independently discussed in the following sections.

Each project was selected and sized to provide the most economical means of accomplishing its purpose, and to return the maximum net benefit. The optimum size of the irrigation projects was considered to be that at which the incremental benefit just equaled the incremental cost, as determined by consideration of primary costs and primary flood control and irrigation benefits. Recreation benefits from multipurpose projects, although considered to be primary in nature, were not used in sizing studies, due to the difficulty in determining the relatively small change in recreational values for different reservoir sizes.

The nature of recreation benefits is such that a detailed economic sizing study could not be made for reservoirs whose principal use would be for recreation purposes. The size, therefore, was based on consideration of reservoir depths to maintain optimum water temperatures for fish life and plants for fish food, water yields to maintain adequate flows at proper temperatures for fish in downstream channels, minimum cost per acre of reservoir water surface, length of shore line and preservation of natural shore line features, and location of natural features affecting placement of structures. Conflicting considerations were balanced against each other within established limits to estimate project size and location for which would provide the maximum total benefit.

Irrigation Benefits

Irrigation water is essential for successful crop production in agricultural areas of the Upper Feather River Basin. The agricultural lands are for the most part located in Sierra Valley along the upper Middle Fork of the Feather River, and in Indian

Valley on the upper tributary system of the North Fork. Present irrigation development in these areas reflects maximum use of the available surface water, supplemented by limited ground water pumping. Water made available from project facilities would comprise both reregulated present flows and a partial new supply, compared with present use. In either case, project water released for downstream use in Sierra and Indian Valleys during the irrigation season would provide a basis for increased agricultural income to local ranchers. The portion of such incremental income which would be net over associated costs would represent the measure of benefit to the irrigation water users from the project, and provide the basis for repayment of project costs allocated to the irrigation function.

There is ample reason to believe that the purposes served by project water would represent a continuation of established practices under an expanded program of operation which would permit fuller utilization of the productive potential of irrigable land. This in turn would result in an increase in the number of beef animals which could be supported by locally produced forage. While it is infeasible to attempt to identify a given quantity of project water with a specific forage crop as a method of value measurement, there are at least two suitable approaches to the problem of determining its benefit to the area of use.

The most simplified procedure which is appropriate for use in measuring the income-producing potential of project water involves assignment of an increment of yield of a given forage crop per unit of new water. Baled meadow hay is an agricultural commodity commonly produced under irrigation in the Upper Feather River Basin, and is considered suitable for use in this analysis. Data

compiled through local interviews indicate an approximate production of one ton of meadow hay per irrigated acre, based on an average present seasonal consumptive use of about 0.9 acre-foot per acre of irrigation water. With project water available in an amount which would permit full consumptive use (1.8 acre-feet per acre per season) under an irrigation schedule appropriate to the area, there appears little doubt but that an additional yield of from 1.5 to 2 tons of hay per acre would be obtained. From this comparison it was concluded that each acre-foot of project water applied to meadow hay land would show an average incremental yield of 1.5 tons of hay. Based on the 10-year period 1946-1955, the gross value of locally produced baled meadow hay was taken to be \$20 per ton, its cost of production was estimated at \$13.25, and the resultant net value component at \$6.75 per ton. The benefit derived by the water users would therefore be \$10 per acre-foot of project water if it were used for hay production.

The other approach to irrigation benefit measurement which is appropriate for this analysis involves assignment of an increment of yield in beef, the commodity which embodies the combined effect of all the factors of production, including irrigation in agricultural enterprises typical of the basin. The application of this approach rests on the assumption that sufficient project water would be available to achieve maximum use of estimated soil productivity within livestock enterprises reflecting a balanced relationship among different categories of forage. Based on average prices and costs prevailing during the period 1946-1955, this approach results in an incremental beef yield which, when expressed in monetary terms, establishes \$8 per acre-foot as the net value of irrigation water to project beneficiaries.

The two methods employed in measuring the income-producing potential of each unit of irrigation water to be made available by the project show a range within which its actual future net value to irrigators most likely may be expected to fall. Therefore, the midpoint of this range, or \$9 per acre-foot, was taken to be a reasonable measure of the average annual primary irrigation benefit which may be expected to accrue to project development. Project water would in a sense supplement existing supplies, and the service areas are capable of making immediate use of it without a prolonged development period. Therefore, this annual benefit was considered to represent an annual value for purposes of benefit-cost comparison in the determination of economic justification.

Flood Control Benefits

Although some degree of flood control in downstream reaches would probably accrue from each of the projects proposed in this report, the annual benefits are relatively insignificant in most cases, due to the small proportion of the total runoff which can be controlled, and the relatively small amount of damage under present conditions. Frenchman Reservoir, however, would provide a significant degree of flood control along Little Last Chance Creek where it flows through Sierra Valley. Flood control benefits in this area were evaluated as described below.

The value of incidental flood control benefits achieved from reservoir storage was assumed to be the difference between the monetary loss from damages under present conditions and the losses from damages under project conditions. Damage accounts for the majority of losses and occurs mainly to agricultural lands in the form of stream bank and sheet erosion; from deposition of debris

in channels, ditches, and fields; loss of irrigation structures and fences; and inundation of meadow lands. A survey was made of damages from recent floods by interviewing farm owners and local officials in the flood area. The 1955 flood, the largest in recent time, provided most of the flood damage data. These damages, together with their respective flood flows, were utilized to establish a flow-damage relationship for the area subject to flooding.

Probable flood flows under project conditions were estimated from flood routing studies, with surcharge storage above the spillway crest utilized for flood control. Inflow hydrographs of various frequencies were derived from unit hydrographs and flow-frequency curves estimated from stream flow records. After being routed through the reservoir, these estimates of flood flows were applied to the previously established flow-damage relationship to estimate damages under project conditions.

Flow-frequency relationships under both present and project conditions were combined with flow-damage data to estimate average annual damages. The difference between the average annual damage under present and project conditions was taken as the measure of the average annual flood control benefit from the project.

Recreation Benefits

No really satisfactory method of converting recreation values to monetary terms had ever been derived when work commenced on this investigation. Among those agencies having occasion to evaluate recreation benefits, the usual practice in the past has been either to use some arbitrary method of conversion, or to leave these benefits expressed in other than monetary terms. In the case

of the Upper Feather River Project, however, some of the projects are almost entirely recreational in nature. Without some monetary value for recreation benefits, it would be impossible to compare projects among themselves, or with other similar projects outside the Upper Feather River Basin that might be built with state funds.

The evaluation of recreation benefits was resolved into three main categories: (1) recreation potential of streams below the dam sites, (2) recreation potential of lands surrounding the reservoirs, and (3) conversion of these potentials into economic terms.

Personnel of the California Department of Fish and Game conducted the investigations under the first category. They also furnished much of the basic information required for evaluation of the other two categories. The results of their studies are discussed subsequently.

The consulting planning firm of Harold F. Wise and Associates was employed to assist in the determination of the second and third categories. In addition, this firm was requested to determine the economic importance of the future public and private recreation developments in the area, and to give specific attention to the following:

1. The potential economic value in terms of net benefits that would result from probable full development of the recreational resources of the Upper Feather River Basin.
2. Estimation of the rate of recreational use and need for public development over the period of economic analysis for each project studied.
3. Development of an acceptable methodology for expressing recreation benefits in economic terms.

A summary report by this firm is included as an appendix to this report. Material contained therein is the basis for economic justification of at-site recreational features.

Stream Recreation Benefits. The recreational potential of the stream affected by the projects was evaluated in terms of present and possible future angler-days by personnel of the Department of Fish and Game. Present use was determined by a sampling survey, by means of interviews, and by counts of angling intensity and distribution. Personal interviews were conducted with 315 people during the 1956 fishing season. These included 245 anglers, and 70 hunters, some of whom did some fishing. This sample represented a party total of 1,279 people. The anglers spent an average of \$9.09 per angler-day. The sample was not totally random, nor was the entire season covered, but the estimate was corrected by use of data from previous angling surveys and from the United States Forest Service.

Angler-days of use along the three streams affected by the possible projects in the North Fork drainage totaled approximately 9,600. Along the streams below the proposed Grizzly Valley and Frenchman Dams, and along the Middle Fork as far as Sloat, angler-days totaled approximately 20,000. The numbers of anglers from different areas of California was roughly proportional to the population and inversely proportional to the distance of those areas from the Upper Feather River Basin. Percentages of the anglers sampled who came from those areas were approximately as follows:

<u>Percentage</u>	<u>Area</u>
47	San Francisco Bay Area
19	Southern California
14	Central counties
11	Plumas County
5	Other northern counties
4	Other states

The results of the survey are likewise presented on Plate 1, entitled "Place of Residence of Anglers Fishing Feather River Basin Streams, 1956"

PLACE OF RESIDENCE
OF
ANGLERS FISHING FEATHER RIVER
BASIN STREAMS
1956



Future use of the streams enhanced by project development for fishing and recreational pursuits was projected to an estimated saturation at the year 2050. The development curve assumed was sufficiently depressed to allow reasonable time intervals for growth of facilities, transportation, and access, and for increased leisure time. Separate curves were projected for conditions with and without the project, the difference being the use of visitor-days creditable to the water project. In every case where a latitude of choice existed, the most conservative number was chosen, in order to improve reliability and reasonableness of results.

The lower reaches of Little Last Chance Creek below the Frenchman Project were deemed to be relatively useless for angling and associated recreation under project conditions. The loss of recreational potential here would be absorbed by the increased recreational potential of the streams of the Indian Creek Project, a few miles to the northwest.

The Grizzly Valley Project, if operated for irrigation, would produce little, if any, benefit to recreational uses of the stream below the project. If operated for recreational purposes the project would have substantial benefits in terms of increased visitor-days.

The ultimate total maximum visitor-days on project streams in the year 2050 was estimated to be 1,600,000 in the Indian Creek Project area, and 2,980,000 below the alternative Grizzly Valley Recreation Project. These numbers, at the ultimate end of the development curve, were used as a basis for computing the average annual recreational use in visitor-days during the economic study period of 50 years after construction. The results of these computations are shown in Table 3.

The net benefit per visitor-day was derived by the firm of Harold F. Wise and Associates and was estimated to be \$2. This figure was used to determine the net benefit due to the projects for each year of a 50-year period of analysis. These annual figures were then converted to a single present-worth figure, and converted into an average annual equivalent benefit for the period.

Reservoir Recreation Benefits. As previously stated, the site planning and derivation of recreation benefits for each reservoir were conducted by the consulting firm of Harold F. Wise and Associates, by contract with the Department of Water Resources. A discussion of criteria and the results of this planning are contained in a summary statement prepared by this firm and appended to this report. Most of the planning assumptions are contained therein, but a few principles are repeated in the following paragraph for emphasis.

Although it is believed that at some future date both public and private facilities will surround the proposed reservoirs, the justification for public investment should be restricted to those benefits derived from the use of only public facilities. It has been further assumed that to encourage and aid full recreational development, minimum basic facilities, such as access roads, sanitary facilities, drinking water, and public campgrounds should be provided by public funds. Likewise, to control development for the greatest public use, all lands of recreational potential surrounding the reservoirs, or immediately downstream from the dam sites, have been assumed to be controlled in the public interest. This would be accomplished either by purchase of the land or by use-permit

if the land is in federal ownership. Later operational policies would dictate the allocation of land for private and public use and administrative procedures to be followed.

Presented in Table 3 are average annual estimated visitor-day use and recreational benefits for both at-site and downstream use of the projects contemplated.

Financial Feasibility

Determination of financial feasibility of the projects studied involved: (1) allocation of the costs among the various purposes, (2) consideration as to what organizations or groups should bear the allocated costs, and (3) consideration of the ability of these organizations or groups to bear such costs.

Cost Allocation

The objective of cost allocation is to provide for equitable distribution of the total multiple-purpose cost among the several purposes served. Or, expressing it another way, the objective is to provide that the savings derived through the use of multiple-purpose structures or facilities are shared by all purposes. This simple objective is very difficult to attain. There is no known method of cost allocation that gives equitable results for all cases. The best single method yet developed is the Separable Costs-Remaining Benefits Method. This method has been recommended by the Federal Inter-Agency River Basin Committee for general use in allocating costs on federal multiple-purpose river basin projects.

TABLE 3

AVERAGE ANNUAL RECREATION VISITOR-DAYS AND BENEFITS
OF INITIAL UNITS OF UPPER FEATHER RIVER BASIN DEVELOPMENT

Project	Visitor-days use*			Average annual project recreation benefits**		
	Without project:	With project:	Net increase due to project:	At-site:	Down-stream:	Total:
Frenchman Project	15,600	39,800	8,600	32,800	\$ 49,900	Negligible \$ 49,900
Grizzly Valley Project	78,300	43,400	74,300	39,400	59,400	Negligible 59,400
Alternative Grizzly Valley Recreation Project	78,300	43,400	397,300	362,400	59,400	\$718,600 778,000
Indian Creek Recreation Project						
Antelope Valley Reservoir	36,800	48,600	79,000	90,800	53,200	85,600 138,800
Dixie Refuge Reservoir	104,300	32,600	259,000	187,300	42,100	241,600 283,700
Abbey Bridge Reservoir	54,300	43,400	135,000	124,100	50,600	139,600 190,200
Indian Creek Recreation Project Total	195,400	124,600	473,000	402,200	\$145,900	\$466,800 \$612,700

* Average annual number of visitor-days for the 50-year period following completion of project.

** Average annual equivalent value, based on present worth of estimated project recreation net benefits for the 50-year period following completion of project.

In the current studies it was assumed that funds to meet the costs of acquiring lands, easements, and rights of way, and for relocating public utilities would be provided by the State. As a result, although included in the total project costs, these items were not allocated among the several purposes. Also, no allocations of costs were made for flood control. This position was justified on the basis that all flood control benefits were incidental to the other reservoir purposes; no features of the projects being designed specifically for flood control. All other project costs were allocated by the Separable Costs-Remaining Benefits Method.

Ability to Pay Reimbursable Costs

In the current studies the reimbursable costs of the project represent that portion of the total costs which could be repaid from sales of project water to project beneficiaries. The amount which irrigators can afford to pay for project water is necessarily dependent upon the net income which they may derive from its use. As previously stated, it was estimated that the net monetary value of project water to the service area of use was \$9 per acre-foot. This amount reflects incremental income after all production and overhead costs have been met, with the exception of payment for water and managerial services required for the successful operation of such enterprises.

The requirement for managerial skill would vary somewhat among various enterprises in the service areas in accordance with available physical and financial resources, but in general it would be relatively high. With recognition of this fact, plus allowance

for variation in requirements for managerial skill among units, it appeared reasonable that an appropriate return to management would fall within the range of one-third to one-half of the computed net value of project water. This would establish a range of maximum amounts which irrigation water users could be expected to pay for project water service.

Repayment

Following the cost allocation, methods by which the various costs would be repaid must be considered. In this report the following premises were assumed.

1. An appropriate governmental agency, possibly the State of California, would provide funds necessary for construction, operation, and maintenance of the projects, and assume the role of creditor insofar as reimbursable costs are concerned.
2. The State of California would adopt a policy of assuming the obligation for the costs of acquiring lands, easements, and rights of way, and of relocating public utilities.
3. The State of California would adopt a policy of assuming the obligation for recreation costs of a state-wide interest.
4. The repayment period would be 50 years, and the interest rate 3 per cent per annum.
5. The marginal profit for irrigators, as expressed by the results of the ability-to-pay analysis and the benefit-cost ratio, would be sufficient to give reasonable assurance that the irrigators would be willing to assume the obligation of repaying costs allocated to the purpose of developing a firm irrigation water supply.

EFFECTS OF UPSTREAM RESERVOIRS ON OPERATION OF OROVILLE RESERVOIR

The combined effect of Frenchman, Grizzly Valley, Abbey Bridge, Antelope Valley, and Dixie Refuge Reservoirs, if operated as proposed in this report, would be to reduce by less than 1 per

cent the water available to Oroville Reservoir during the critical dry period. This reduction in water supply would cause a loss at Oroville of about 2,900 kilowatts in primary power generation capacity, and an annual reduction of about 8,600,000 kilowatt-hours in the amount of electrical energy that could be generated. The effect on secondary power generation would be negligible. Also, since flood waters from the drainage areas of these reservoirs normally arrive at Oroville Reservoir considerably after the flood crest at Oroville has occurred, the beneficial effects of these reservoirs for flood control below Oroville would be negligible.

While detailed operation studies for Oroville Reservoir are still in progress to determine these effects more precisely, the above estimates were made by primary power operation studies for the critical period July, 1930, through November, 1934. These calculations were based on operation studies of Oroville Reservoir in conjunction with the five upstream reservoirs; net reduction in stream flow was calculated on a monthly basis considering evaporation and additional consumptive use in Sierra and Indian Valleys during the critical period. Table 4 presents estimates of reduction in critical period water supply and resultant loss in primary power generation and dependable capacity at the Oroville Power Plant due to each of the five upstream reservoirs.

STATE WATER RIGHTS AND FEDERAL POWER PERMITS

A number of applications have been filed with the State Water Rights Board for permits to appropriate water, and with the Federal Power Commission for preliminary power permits, in furtherance of proposed projects in the Upper Feather River Basin. A summary of the pending water right applications for proposed projects

TABLE 4

EFFECTS OF UPSTREAM RESERVOIRS
ON OPERATION OF OROVILLE RESERVOIR

Reservoir	Reduction in water supply at Oroville Reservoir during critical period July, 1930-November, 1934: In acre-feet	In per cent of total water supply*	Annual reduction in primary power generation, in kilowatt-hours	Loss in dependable power capacity, in kilowatts
Frenchman	31,500	0.29	3,700,000	1,240
Grizzly Valley	27,700	0.25	3,100,000	1,060
Abbey Bridge	8,700	0.08	1,000,000	340
Antelope Valley	8,000	0.07	900,000	300
Dixie Refuge	<u>-1,000</u>	<u>-0.01</u>	<u>- 100,000</u>	<u>- 40</u>
TOTALS	75,000	0.68	8,600,000	2,900

* Water supply during critical period at Oroville Reservoir is equal to the available storage plus the critical period inflow, and totals about 10,937,000 acre-feet. Dependable capacity of electric generating facilities at Oroville is about 410,000 kilowatts.

is contained in the ensuing portion of this report. In addition, Table 5 includes a tabulation of all major applications, for amounts in excess of 3 second-feet of diversion or 200 acre-feet of storage, filed since December 19, 1914. This tabulation does not include either riparian rights or appropriative rights initiated prior to December 19, 1914, neither of which are of record with any state agency except in the Indian and Sierra Valley areas where there have been adjudications of water rights.

Water Right Applications

Applications for proposed major projects on the Middle and North Forks of the Feather River and their tributaries have been filed by the Richvale Irrigation District, R. P. Wilson, and the State Department of Finance. The Pacific Gas and Electric Company is in the process of constructing certain projects on the North Fork of the Feather River and its tributaries. These projects of the company are under applications upon which permits have been issued covering the necessary water rights.

Richvale Irrigation District. Application 13681 was filed on April 10, 1950, and seeks to appropriate 132,000 acre-feet per annum from the Middle Fork of the Feather River, of which 72,000 and 60,000 acre-feet are to be impounded in Clio and Nelson Point Reservoirs, respectively. Water stored in these reservoirs would be released to flow down the natural channels of the Middle Fork of the Feather River and the Feather River to the Sutter Butte diversion dam, located within the SW1/4 of SE1/4 of Section 33, T19N, R3E, MDB&M, where these waters would be rediverted for irrigation of some 24,500 net acres within the boundaries of the Richvale Irrigation District.

PERMITS FOR DIVERSIONS TO APPROPRIATE WATER ON NORTH AND MIDDLE FORKS
OF FEATHER RIVER AND SUBSIDIES THEREON, EXCLUDING WEST BRANCH OF NORTH FORK

Appli- cation: number:	Date filed:	Name of applica- tion:	Source of water	Point of diversion, referred to M.D.B.&M.:	Amount of water* In : In :	second- : acre- : feet :	Purpose :	Status :
2195	-10-21	Pacific Gas and Elec- tric Company	North Fork Feather River	SE 33 24N 7E	55,000	Power	License	
4491	3-5-25	Pacific Gas and Elec- tric Company	Bricks Creek, Grizzly Creek	SW NE 34 24N 6E	175	Power	License	
4508	5-22-25	Pacific Gas and Elec- tric Company	Grizzly Creek	SW NE 34 24N 6E	105	Power	License	
4671	12-21-25	Pacific Gas and Elec- tric Company	Grizzly Creek	SW NE 34 24N 6E	20	Power	License	
5204	2-27-29	Paradise Irrigation District	North Fork Feather River	SW SW 32 24N 4E	5,000	Irriga- tion	Permit	
6241	4-8-29	Pacific Gas and Elec- tric Company	1 1/2 streams tributary to North Fork Feather River	24N 7E	65	Power	License	
7003	7-10-31	Anna W. Shoote and Marion T. Higgins	Black Hawk Creek	NE SE 27 25N 9E	4.6	Municipal, domestic	License	
9284	4-20-38	R. L. Holingsworth, et al	Frazier Creek Dams Ravine Nelson Creek	Lot 7 of 30 Lot 5 of 30 22N Lot 10 of 31	15	Municipal, domestic	Permit	
9900	1-9-40	Pacific Gas and Elec- tric Company	North Fork Feather River	Belden, Cresta, Poe Dams	3,500	Power	Permit	
13681	4-10-50	Richvale Irrigation District	Middle Fork Feather River Frazier Creek Gray Eagle Creek	SE 23 22N 12E SE 22 22N 12E NW 22 22N 12E	132,000	Irriga- tion, domestic	Applica- tion	
13682	4-10-50	Richvale Irrigation District	Middle Fork Feather River	SW 8 23N 11E	300	Power	Applica- tion	

TABLE 5 (Continued)

MAJOR APPLICATIONS TO APPROPRIATE WATER ON NORTH AND MIDDLE FORKS OF FEATHER RIVER AND TRIBUTARIES ABOVE OROVILLE DAM SITE, EXCLUDING WEST BRANCH OF NORTH FORK

Applica- tion: number:	Date filed	Name of applicant	Source of water	Point of diversion, referred to M.D.B. 2nd.	Amount of water*: In : In :	Purpose	Status
				: : :Sec--:Town--: : 1/4 : 1/4 :tion:ship :Range: feet : feet :	: second--: acre-: :		

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each of the following categories:
 (1) Contributions to appropriate Washington State publications or periodicals.
 (2) Contributions above \$100 made by individuals or corporations to the Feather River Valley Chamber of Commerce.
 (3) Contributions to appropriate Washington State organizations or institutions.
 (4) Contributions to appropriate Washington State educational institutions.
 (5) Contributions to appropriate Washington State cultural institutions.
 (6) Contributions to appropriate Washington State sports teams.
 (7) Contributions to appropriate Washington State youth organizations.
 (8) Contributions to appropriate Washington State community organizations.
 (9) Contributions to appropriate Washington State religious organizations.
 (10) Contributions to appropriate Washington State social service organizations.
 (11) Contributions to appropriate Washington State health care organizations.
 (12) Contributions to appropriate Washington State environmental organizations.
 (13) Contributions to appropriate Washington State historical societies.
 (14) Contributions to appropriate Washington State museums.
 (15) Contributions to appropriate Washington State libraries.
 (16) Contributions to appropriate Washington State archives.
 (17) Contributions to appropriate Washington State research centers.
 (18) Contributions to appropriate Washington State think tanks.
 (19) Contributions to appropriate Washington State policy institutes.
 (20) Contributions to appropriate Washington State public affairs offices.
 (21) Contributions to appropriate Washington State media outlets.
 (22) Contributions to appropriate Washington State news organizations.
 (23) Contributions to appropriate Washington State broadcast stations.
 (24) Contributions to appropriate Washington State print publications.
 (25) Contributions to appropriate Washington State electronic publications.
 (26) Contributions to appropriate Washington State websites.
 (27) Contributions to appropriate Washington State mobile applications.
 (28) Contributions to appropriate Washington State social media platforms.
 (29) Contributions to appropriate Washington State video production companies.
 (30) Contributions to appropriate Washington State film production companies.
 (31) Contributions to appropriate Washington State television networks.
 (32) Contributions to appropriate Washington State radio stations.
 (33) Contributions to appropriate Washington State podcasting networks.
 (34) Contributions to appropriate Washington State digital marketing agencies.
 (35) Contributions to appropriate Washington State advertising agencies.
 (36) Contributions to appropriate Washington State public relations firms.
 (37) Contributions to appropriate Washington State consulting firms.
 (38) Contributions to appropriate Washington State management firms.
 (39) Contributions to appropriate Washington State legal firms.
 (40) Contributions to appropriate Washington State accounting firms.
 (41) Contributions to appropriate Washington State engineering firms.
 (42) Contributions to appropriate Washington State architecture firms.
 (43) Contributions to appropriate Washington State interior design firms.
 (44) Contributions to appropriate Washington State landscaping firms.
 (45) Contributions to appropriate Washington State construction firms.
 (46) Contributions to appropriate Washington State real estate firms.
 (47) Contributions to appropriate Washington State insurance firms.
 (48) Contributions to appropriate Washington State financial planning firms.
 (49) Contributions to appropriate Washington State investment firms.
 (50) Contributions to appropriate Washington State venture capital firms.
 (51) Contributions to appropriate Washington State private equity firms.
 (52) Contributions to appropriate Washington State hedge funds.
 (53) Contributions to appropriate Washington State mutual funds.
 (54) Contributions to appropriate Washington State pension funds.
 (55) Contributions to appropriate Washington State endowments.
 (56) Contributions to appropriate Washington State foundations.
 (57) Contributions to appropriate Washington State trusts.
 (58) Contributions to appropriate Washington State estates.
 (59) Contributions to appropriate Washington State probate courts.
 (60) Contributions to appropriate Washington State family law attorneys.
 (61) Contributions to appropriate Washington State divorce attorneys.
 (62) Contributions to appropriate Washington State bankruptcy attorneys.
 (63) Contributions to appropriate Washington State criminal defense attorneys.
 (64) Contributions to appropriate Washington State civil litigation attorneys.
 (65) Contributions to appropriate Washington State intellectual property attorneys.
 (66) Contributions to appropriate Washington State tax attorneys.
 (67) Contributions to appropriate Washington State business law attorneys.
 (68) Contributions to appropriate Washington State contract law attorneys.
 (69) Contributions to appropriate Washington State tort law attorneys.
 (70) Contributions to appropriate Washington State personal injury attorneys.
 (71) Contributions to appropriate Washington State medical malpractice attorneys.
 (72) Contributions to appropriate Washington State product liability attorneys.
 (73) Contributions to appropriate Washington State premises liability attorneys.
 (74) Contributions to appropriate Washington State wrongful death attorneys.
 (75) Contributions to appropriate Washington State defamation attorneys.
 (76) Contributions to appropriate Washington State trademark attorneys.
 (77) Contributions to appropriate Washington State patent attorneys.
 (78) Contributions to appropriate Washington State copyright attorneys.
 (79) Contributions to appropriate Washington State trade secret attorneys.
 (80) Contributions to appropriate Washington State franchise attorneys.
 (81) Contributions to appropriate Washington State employment law attorneys.
 (82) Contributions to appropriate Washington State labor law attorneys.
 (83) Contributions to appropriate Washington State union law attorneys.
 (84) Contributions to appropriate Washington State immigration attorneys.
 (85) Contributions to appropriate Washington State naturalization attorneys.
 (86) Contributions to appropriate Washington State citizenship attorneys.
 (87) Contributions to appropriate Washington State visa attorneys.
 (88) Contributions to appropriate Washington State asylum attorneys.
 (89) Contributions to appropriate Washington State refugee attorneys.
 (90) Contributions to appropriate Washington State deportation attorneys.
 (91) Contributions to appropriate Washington State reentry attorneys.
 (92) Contributions to appropriate Washington State expatriation attorneys.
 (93) Contributions to appropriate Washington State dual citizenship attorneys.
 (94) Contributions to appropriate Washington State foreign birth certificates.
 (95) Contributions to appropriate Washington State foreign passports.
 (96) Contributions to appropriate Washington State foreign visas.
 (97) Contributions to appropriate Washington State foreign work permits.
 (98) Contributions to appropriate Washington State foreign residency permits.
 (99) Contributions to appropriate Washington State foreign driver's licenses.
 (100) Contributions to appropriate Washington State foreign identification documents.

Application Number	Date Filed	Name of Applicant	Source of Water	Point of diversion, referred to M.D. 3.2M.	Amount of water: In : In :	Purpose	Status
:	:	:	:	:Sec-:Town-:	:second-: acre-:	:	:
:	:	:	:	:tion:ship :Range: feet :	: feet :	:	:
16950**	3-20-56	State Department of Finance	Big Grizzly Creek	1 23N 13E	49,000	Recreation, municipal, irrigation	Applica-tion
16951**	3-20-56	State Department of Finance	Indian Creek	22,23 27N 12E	18,200	Recreation, stream flow main-tenance	Applica-tion
16952**	3-20-56	State Department of Finance	Little Last Chance Creek	33 24N 16E	30,000	Irrigation	Applica-tion
16953**	3-20-56	State Department of Finance	Last Chance Creek	23 26N 14E	14,300	Recreation, stream flow main-tenance	Applica-tion
16954**	3-20-56	State Department of Finance	Red Clover Creek	30 25N 13E	8,400	Recreation, stream flow main-tenance	Applica-tion

* Only those applications for amounts exceeding 3 second-feet of diversion or 200 acre-feet of storage per annum are tabulated.

*** Jurisdiction transferred to State Department of Water Resources by virtue of Chapter 52, Statutes of 1956.

Application 13682 was filed on April 10, 1950, and seeks to appropriate 300 second-feet from the Middle Fork of the Feather River for power purposes. Under this application water would be stored behind Clio Dam, located within the SE1/4 of SE1/4 of Section 23, T22N, R12E, MDB&M, and diverted at Nelson Point Dam through Power House No. 1, located at the base of said dam within the SE1/4 of SE1/4 of Section 13, T23N, R9E, MDB&M; rediverted at Minerva Dam for use through Sherman Power House No. 2, located in the SE1/4 of NW1/4 of Section 36, T23N, R8E, MDB&M; rediverted at Dogwood Dam for use through Hartman Power House No. 3, located within SE1/4 of NE1/4 of Section 11, T22N, R7E, MDB&M; rediverted at Hartman Dam for use through Millsap Power House No. 4, located within Lot 2 of Section 2, T21N, R7E, MDB&M; and rediverted at Bald Rock Dam for use through Bald Rock Power House No. 5, located within SW1/4 of NW1/4 of Section 35, T21N, R6E, MDB&M.

Applications 14919 and 14920 were filed on July 21, 1952, and seek to appropriate a maximum of 1,300 second-feet direct diversion, and a total of 381,000 acre-feet per annum storage from the Middle Fork of the Feather River for irrigation and power purposes, respectively. The following summarizes pertinent data described under these two applications.

Point of diversion	: Direct diversion and re- : diversion under Applica- : tion 14920, in second-feet:	: Storage under Appli- : cations 14919 and : 14920, in acre-feet
Clio Dam	0	131,000
Nelson Point Dam	800	116,000
Minerva Dam	800	500
Dogwood Dam	900	1,250
Hartman Dam	1,000	250
Bald Rock Dam	1,300	5,000
Subtotal		254,000
Plus 50 per cent refill		127,000
TOTAL		381,000

Pertinent data pertaining to the power development proposed on the Middle Fork of the Feather River, as set forth under water right Application 14920, are tabulated below:

<u>Power house</u>	<u>Maximum static head, in feet</u>	<u>Maximum draft, in second-feet</u>	<u>Maximum theoretical horsepower</u>
No. 1, Nelson Point	360	800	32,750
No. 2, Sherman	710	800	64,500
No. 3, Hartman	640	900	65,500
No. 4, Millsap	740	1,000	84,100
No. 5, Bald Rock	690	1,300	<u>102,000</u>
TOTAL			348,850

Applications 15551 and 15552 were received on September 25, 1953, seeking appropriations for irrigation and power purposes, respectively. Each application seeks to appropriate 40,000 acre-feet per annum from Big Grizzly Creek for storage in Grizzly Valley Dam, and 16,000 acre-feet per annum from Frazier Creek for storage in Gold Lake Dam. The general plan of development under these two applications would be to release the stored waters into the natural channel of Grizzly Creek and Frazier Creek to Clio and Nelson Point Reservoirs. From these reservoirs the waters would be diverted through the chain of power houses described under Applications 13682 and 14920, thence down the Feather River to Sutter Butte Dam where the waters would be diverted for irrigation purposes within the boundaries of the district.

Applications 16340 and 16341 were received on April 26, 1955, and propose an appropriation of 40,000 acre-feet per annum from Little Last Chance Creek for irrigation and power purposes, respectively. Water diverted to storage on Little Last Chance Creek would be released down the natural stream channels to Clio Reservoir, where it may be regulated or by-passed and thence

rediverted at Nelson Point Dam through the chain of power houses on the Middle Fork of the Feather River described under Applications 13682 and 14920. Subsequent to use for power purposes, water would be rediverted from the Feather River at Sutter Butte Dam for irrigation purposes within the boundaries of the district.

All of the applications of the Richvale Irrigation District, except 16340 and 16341, have been completed and public notice thereof given. Numerous protests have been filed, and the matter is now awaiting a hearing by the State Water Rights Board. Applications 16340 and 16341 have not yet been completed by the district.

R. P. Wilson. Mr. R. P. Wilson has two applications pending before the State Water Rights Board covering projects on tributaries of the North Fork of the Feather River. At one time Mr. Wilson had a third application filed for a comprehensive development on the Middle Fork of the Feather River, which development was similar to that proposed by the Richvale Irrigation District. This application was cancelled, however, by the former Division of Water Resources for failure to complete. The active applications are currently in the name of the Natural Youth Foundation of which Mr. Wilson is President.

The details of Mr. Wilson's applications on tributaries of the North Fork of the Feather River are as follows:

Application 13694 was filed on April 17, 1950, and seeks to appropriate a total diversion of 800 second-feet and 12,000 acre-feet per annum for storage from Indian Creek, Spanish Creek, and the East Branch of the North Fork of the Feather River. This application proposes to use the water for power purposes through four power houses, as follows: Indian Creek Power House No. 1, located

within the NW1/4 of NE1/4 of Section 15, T25N, R9E, MDB&M; East Branch Power House No. 2, located within the NE1/4 of NW1/4 of Section 22, T25N, R7E, MDB&M; Millsap Creek Power House No. 3, located within the NE1/4 of SW1/4 of Section 19, T25N, R7E, MDB&M; and Spanish Creek Power House No. 4, located within the NW1/4 of the NE1/4 of Section 16, T25N, R9E, MDB&M.

Application 13744 was filed on May 18, 1950, and seeks to appropriate 10,000 acre-feet per annum for storage from Moonlight Creek, and diversion of 100 second-feet and 15,000 acre-feet per annum for storage from Lights Creek, for use for power purposes through three power houses as follows: Power House No. 1, located within the SE1/4 of NW1/4 of Section 19, T27N, R11E, MDB&M; Power House 1A, located within the SE1/4 of the NW1/4 of Section 19, T27N, R11E, MDB&M; and Power House No. 2, located within the SW1/4 of SW1/4 of Section 31, T27N, R11E, MDB&M.

Mr. Wilson has completed his two applications and they are now in the process of being advertised.

Department of Finance Applications. On March 20, 1956, the State Department of Finance filed water right Applications 16950, 16951, 16952, 16953, and 16954, which propose storage in the reservoirs included in the area of this investigation. These applications were filed under Part 2, Division 6 of the Water Code in a trustee capacity in accordance with Section 10500 of the code, which provides in part as follows:

"The Department of Finance shall make and file applications for any water which in its judgment is or may be required in the development and completion of the whole or any part of a general or coordinated plan looking toward the development, utilization, or conservation of the water resources of the State."

Section 10504 of the Water Code, which relates to the applications filed under Section 10500, states in part as follows:

"The Department of Finance may release from priority or assign any portion of any appropriation filed by it under this part when the release of assignment is for the purpose of development not in conflict with such general or coordinated plan"

The Department of Water Resources, by virtue of Chapter 52, First Extraordinary Session of the 1956 Legislature, has had transferred to it all duties, responsibilities, and powers formerly vested in the Department of Finance under said Part 2, Division 6 of the Water Code.

The details of these applications are as follows:

Application 16950 proposes an appropriation by storage of 49,000 acre-feet per annum from Big Grizzly Creek in Grizzly Valley Reservoir, at a point within Section 1, T23N, R13E, MDB&M. The stored water is to be used for recreation purposes, to maintain the flows in Big Grizzly Creek and the Middle Fork of the Feather River below the Grizzly Valley reservoir site to Nelson Point Dam, for municipal use at Portola and other urban areas within the Middle Fork Service Area, and for irrigation use in Mohawk Valley and Long Valley.

Application 16951 proposes an appropriation by storage of 18,200 acre-feet per annum from Indian Creek in Antelope Valley Reservoir, located in Sections 22 and 23, T27N, R12E, MDB&M. Stored water under this application is to be used for recreation at the Antelope Valley reservoir site and for stream flow maintenance along the channel of Indian Creek below the reservoir to Indian Valley.

Application 16952 proposes an appropriation by storage of 30,000 acre-feet per annum from Little Last Chance Creek in Frenchman Reservoir, at a point within Section 33, T24N, R16E, MDB&M. Water stored under this application is to be used for irrigation purposes in Sierra Valley.

Application 16953 proposes an appropriation by storage of 14,300 acre-feet per annum from Last Chance Creek in Dixie Refuge Reservoir, at a point within Section 23, T26N, R14E, MDB&M. Stored water under this application is to be used for recreation at the Dixie Refuge reservoir site, and for stream flow maintenance along the channel of Last Chance Creek below the reservoir site to Indian Valley.

Application 16954 proposes an appropriation by storage of 8,400 acre-feet per annum from Red Clover Creek in Abbey Bridge Reservoir, at a point within Section 30, T25N, R13E, MDB&M. Water stored under this application is to be used for recreation at the Abbey Bridge reservoir site, and for stream flow maintenance along the channel of Red Clover Creek below the reservoir site to Indian Valley.

The applications filed by the Department of Finance (now held by the Department of Water Resources) have not been assigned or completed.

Applications Pending Before Federal Power Commission

Both the Richvale Irrigation District and the Pacific Gas and Electric Company have applications for preliminary permit pending before the Federal Power Commission covering proposed major power projects along the Middle Fork of the Feather River and

certain tributaries thereto. These projects before the commission are No. 2134 for the Richvale Irrigation District, and No. 2136 for the Pacific Gas and Electric Company.

Notice of the Federal Power Commission dated July 22, 1953, describes Project 2134 for preliminary permit as consisting of two large dams across the Middle Fork of the Feather River at the Clio and Nelson Point dam sites; a series of four diversion dams across the Middle Fork of the Feather River at Minerva Bar, Onion Valley, Hartman Bar, and Bald Rock; tunnels aggregating about 23.4 miles in length; and five power houses on the Middle Fork of the Feather River between Nelson Point Reservoir and Oroville Reservoir, the latter reservoir being presently proposed for construction by the State of California.

Project 2136 of the Pacific Gas and Electric Company, as described in Federal Power Commission notice dated July 22, 1953, describes that project as consisting of a development on the Middle Fork of the Feather River and its tributaries and on French Creek, consisting of five dams and reservoirs at Grizzly Valley, Clio, Gold Lake, Nelson Point, and French Creek, with a total gross storage capacity of 415,000 acre-feet; a system of tunnels aggregating about 23 miles in length; and four power houses located at Nelson Point, Onion Valley, Willow Creek, and French Creek.

The Department of Water Resources understands that the Pacific Gas and Electric Company and the Richvale Irrigation District are currently carrying on negotiations with each other with respect to construction of these two projects.

The Federal Power Commission has not yet issued preliminary power permits to either of these agencies, nor has it indicated whether or not a hearing will be necessary.

Mr. R. P. Wilson has three applications pending before the Federal Power Commission for preliminary permits on Projects 2124, 2125, and 2126.

Notice of the Federal Power Commission dated April 22, 1953, describes Project 2124 as consisting of: (1) six dams and reservoirs on the Middle Fork of the Feather River, located near Washington Creek, Bear Creek, Willow Creek, Ament Creek, Cold Water Creek, Middle Fork of the Feather River, or alternative locations; tunnels; and four power houses and three alternative power houses, (2) two dams on the South Branch of the Feather River, tributary to the Middle Fork of the Feather River near Yard House and Brown Hill, together with accompanying tunnel and power house on Cascade Creek, (3) three dams on Fall River adjacent to Nelson Crossing, upstream from Feather Falls, and at Dark Canyon, together with three tunnels and two power houses, and (4) a dam on the Little North Fork of the Feather River, tributary to the Middle Fork of the Feather River, together with a tunnel and power house located near Crooked Ear.

Notice of the Federal Power Commission dated July 22, 1953, describes Project 2125 as consisting of: (1) a dam across Lights Creek, a tunnel 16,500 feet long, and Lights Creek Power House No. 1, (2) a dam across Lights Creek forming Lower Lights Creek Reservoir, a tunnel of 6,000 feet, and Lights Creek Power House No. 2, and (3) a dam across Moonlight Creek, 7,000 feet of tunnel, and Lights Creek Power House No. 3.

Notice of the Federal Power Commission dated July 21, 1953, describes Project 2126 as consisting of four dams on the East Branch of the North Fork of the Feather River and tributaries,

and on Indian Creek and Spanish Creek in Plumas County, together with 11.5 miles of tunnel and four power houses.

The Federal Power Commission has not yet issued preliminary power permits on any of Mr. Wilson's projects, nor has it indicated whether or not hearings will be necessary before issuing preliminary permits.

It should be noted that the Middle Fork of the Feather River power developments, as proposed under applications for preliminary power permits before the Federal Power Commission by the Richvale Irrigation District, Pacific Gas and Electric Company, and R. P. Wilson, are in conflict.

CHAPTER III. FRENCHMAN AND GRIZZLY VALLEY PROJECTS

The Frenchman and Grizzly Valley Projects would develop a supplemental water supply for irrigation use in portions of Sierra Valley, provide incidental flood control to lands and structures below the reservoirs, and would form the basis for an outdoor recreational area.

Project Area

Sierra Valley is located in a mountainous area in the southeastern portion of Plumas County and the northeastern portion of Sierra County. It is the largest mountain valley completely within the State, comprising about 115,000 acres, of which 94,000 acres are potentially irrigable. Under plans for the Frenchman and Grizzly Valley Projects, supplemental water would serve lands in Plumas County in the northern portion of the valley.

Climate

The predominating feature of the climate of Sierra Valley is the aridity. The average seasonal depth of precipitation on the valley floor is about 15 inches. The other major climatic characteristics are an abundance of sunshine, wide range of temperature, low humidity, and rapid evaporation. More than 90 per cent of the total precipitation normally occurs between the first of October and the last of May, about one-half of it being in the form of snow.

The elevation of the valley floor approaches 5,000 feet. Consequently, killing frosts can occur during any month of the year, and the average growing season for tender-leaf vegetation is only

29 days. For climatically adapted crops, the growing season is approximately 90 days. However, the generally cool summer nights result in relatively low yields.

Winters are moderately severe, with the monthly minimum temperature remaining below freezing during the period from November through March. Snow on the valley floor melts about March 1st, while that on the surrounding mountains generally begins to melt by March 15th. Snowmelt runoff generally declines to the point where some streams flowing into the valley are dry by May 15th, and even the major streams approach their minimum flow by June 15th. In the years when heavy snowfall is experienced in the mountains, considerable flood damage occurs to downstream ranches and roads. This damage comprises washed-out fences, roads, and bridges and deposition of silt on the lands.

Soils

Soils derived from lacustrine depositions occupy the greater portion of Sierra Valley. These soils have been developed from sediments carried by streams into a fresh-water lake. As is common with this type of deposition, the coarser materials dropped first and the finer materials were carried out into the middle of the lake. Thus a wide textural range has been developed, with a predominance of fine-grained or loam-textured soils underlain by fine-textured subsoils. This has created drainage problems, and has been largely responsible for much of the salinity and alkalinity conditions to be found within Sierra Valley. Many of these problems could be overcome by artificial drainage. In general, all of these lands are suitable for medium- and shallow-rooted,

climatically adapted crops, and to a lesser extent to alfalfa where soil depth permits.

Land Use

Agriculture in Sierra Valley is completely dominated by beef cattle production in owner-operated enterprises, with most of the present owners being descendants of families that migrated to California during the gold rush days. They are, therefore, well established in farming practices suited to the natural characteristics of the area. The major portion of the valley is used for range pasture in its natural state, with an estimated average brush-land carrying capacity of 12 acres per mature animal for the period of May through October. Improved range land or land with no brush is estimated to have a carrying capacity of six acres per mature animal for the same period.

Irrigation is of importance in the maturation and successful production of crops in Sierra Valley. Natural meadows are located in proximity to the small creeks flowing out onto and across the valley floor. In accordance with available natural runoff, these meadow lands are irrigated by wild flooding, and are used to produce a relatively high-quality hay for winter feeding, with an estimated average yield of one ton per acre. In the more sheltered portions of the valley, alfalfa and domestic grasses have replaced the native grasses as a source of hay and green forage. Some dry grain and grain hay are produced in the valley, but the lack of moisture during the growing season results in generally poor yields.

Population

A total of seven communities are scattered around the fringe of Sierra Valley, ranging in size from less than fifty to several thousand inhabitants. Three of these, Chilcoot, Vinton, and Beckwourth, are located in the immediate project area. A fourth, Portola, located along the Middle Fork of the Feather River several miles downstream from the outlet of the valley, would be directly affected by construction of the proposed projects. The acreage in the individual ranch holdings in the project area is large, ranging from about 320 acres to 4 200 acres. Consequently, the number of farm families that would benefit from construction of the projects is small. It is estimated that in the project area, excluding Portola, there are about 400 inhabitants.

Natural and Human Resources

As stated previously, the agricultural economy of Sierra Valley is devoted to beef production, and as a result the income accruing is dominated by market conditions for beef feeder-cattle and calves. However, it is recognized that the valley is suitable to the production of hardy varieties of row and truck crops which might conceivably be quite profitable. In spite of this, it is the opinion of many local residents and county agricultural technicians that, for the foreseeable future, the valley will continue to depend upon the same economic base as at present.

The natural resources of the area consist largely of the unregulated waters in streams that enter onto the valley floor and the timber that grows on mountain slopes. Some mineral deposits exist in the mountains surrounding the valley, but at the present time there is no mining activity.

Several sawmills are located in the valley, and timber is hauled for sawing from the surrounding mountainous areas.

Transportation

An excellent transportation system traverses the project area. A major east-west highway, U. S. Highway 40 Alternate, and the main line of the Western Pacific Railroad, extend across northern Sierra Valley. Several secondary roads of varying capacity and condition provide access to the surrounding areas.

Need for Project Development

Sierra Valley is located in one of the most attractive recreation areas in California. Each year thousands of people from all parts of the State travel to the Feather River Basin to fish, hunt, camp, and enjoy the natural scenic beauty. As stated, an excellent transportation system serves the area and affords easy access for visitors. Further development of the water resources of the Feather River Basin would provide an opportunity for additional development of its recreational facilities.

Better regulation of the available water supply is urgently needed in Sierra Valley. Runoff from the streams entering onto the valley floor, formed largely from melting snows, comes as torrential floods in the spring but drops sharply soon thereafter. The high spring flows run unused, and spread out over the valley floor, causing considerable flood damage. Yet, because of late-season water shortage, thousands of acres of farm land produce only part of their potential. Other lands, capable of sustained crop production, are still in sagebrush for lack of water. This

shortage of water for irrigation use, particularly during the late irrigation season, makes it essential that supplemental water supplies be developed, if the potential of the region is to be more nearly realized.

At present, no storage reservoirs for regulating stream flow exist on the streams that enter Sierra Valley. Irrigation water is commonly applied to lands adjacent to the stream channels by a series of simple check dams, which cause the water to back up and spread laterally over the meadows, and to more distant lands by small unlined ditches equipped with wooden turnout structures.

Local Cooperation

Present practice for the distribution of irrigation water in Sierra Valley is by individual operators. For the Frenchman and Crowley Valley Projects, it has been assumed that a contract for water sales would be made by the constructing agency with a legally responsible district, such as the Last Chance Creek Water District. The district would then be responsible for water distribution and the collection and repayment of the reimbursable costs.

Local water users have demonstrated an active interest in the proposed development for Sierra Valley, as evidenced by the meeting of the Last Chance Creek Water District in the summer of 1961. There is as yet, however, no indication as to the extent of their willingness to repay the reimbursable costs of the projects. Such information cannot be obtained until this report is made available to the water users for study. Public hearings and discussions on this report are considered both appropriate and necessary.

Present and Future Water Use

In Sierra Valley at the present time there is an average consumptive use of applied water of about 81,700 acre-feet per season. It is estimated that there are about 95,000 acres of irrigable land in the valley. For full irrigation development of this land about 202,000 acre-feet of applied water would be required seasonally. This would result in a seasonal consumptive use of about 161,000 acre-feet. The average seasonal inflow from the streams entering the valley is about 155,000 acre-feet, and the seasonal amount of precipitation averages less than 15 inches, indicating there is probably insufficient water in the valley for full development of all the irrigable land. Also, because of the physical position of the valley, it is probable that the future use of water will be limited to the amount of the local supply that can be economically developed.

The potential Frenchman and Grizzly Valley Projects Service Area occupies some 31,600 acres in the northern portion of Sierra Valley. This service area includes the Last Chance Creek Water District, and an 8,100-acre area lying to the north of, and contiguous to, the district. Of these 31,600 acres, about 30,300 acres have been classified as irrigable. It is estimated that the ultimate seasonal requirement of this area would be approximately 72,500 acre-feet.

The combined yield of the Frenchman and Grizzly Valley Projects would fully irrigate some 12,900 acres. About 2,400 acres of land within the service area are presently receiving early-season irrigation water from sources other than Little Last Chance and Grizzly Creeks. The residual 15,000 acres of irrigable land within the service area would remain unirrigated until additional sources of water become available.

FRENCHMAN PROJECT

The Frenchman Project is a proposed reservoir and system of works to regulate the waters of Little Lost Chance Creek for irrigation use in Sierra Valley, provide flood control downstream, and form the basis for enhancement of an outdoor recreational area. Its operation would provide a regulated water supply of about 16,000 acre-feet seasonally, of which 12,000 acre-feet would be new water that is presently unavailable to irrigators in the valley. In addition, the presently available unregulated water, by means of regulation, could be used more effectively and over a longer irrigation period than at present.

The operation of the project would provide incidental flood control benefits. In the operation studies of Frenchman Reservoir a large portion of storage space was made for flood control purposes. However, a rise above the regulated spillway crest would not cause a high degree of flooding, due to by regulating the peak flows entering the reservoir. It was estimated that a once-in-five-hundred-year flood peak would be reduced from about 6,400 second-feet to about 2,700 second-feet. It was further estimated that a once-in-one-hundred-year flood peak would be reduced from 4,400 second-feet to about 1,300 second-feet, a flow that would cause little damage.

The construction of the project would enhance an outdoor recreational area by providing a setting for the building of camp sites, boating facilities, and summer homes. Both the area surrounding the reservoir site and the canyon downstream would be made exceedingly attractive for this type of development.

Plan of Development

The Frenchman Project is to consist of a dam and reservoir.

*Frenchman
Reservoir Area*



*Little Lost
Chance Creek
Canyon Below
Frenchman
Reservoir*

on Little Last Chance Creek, about 1 mile downstream from its confluence with Frenchman Creek, basic recreational facilities, and access roads.

The existing stream channel of Little Last Chance Creek from the dam site downstream to Sierra Valley would be utilized in conveying the water to the service area for irrigation use. In the service area, the many existing channels and structures would be utilized to apply the water to the land. Features of the project and its potential service area are shown on Plate 3, entitled "Frenchman and Grizzly Valley Projects".

Service Area

The proposed service area of the Frenchman Project comprises the same lands which now receive water from Little Last Chance Creek. All of this area lies within the boundaries of the existing Last Chance Creek Water District. This district encompasses approximately 23,500 acres of irrigable lands, an area larger than could be irrigated by locally developable water supplies. At present, about 8,200 acres of this district are receiving some irrigation water, most of which is available only in the early spring. The water rights are adjudicated and apportioned by a State Watermaster. It is estimated that approximately 1,700 acres could receive a full irrigation supply from the water that is presently being put to beneficial use. An additional 5,000 acres could receive a full irrigation supply from the new seasonal yield developed by the Frenchman Project.

General Features of Project

Frenchman Reservoir would have a gross storage capacity

of 50,000 acre-feet and a net storage capacity of 48,700 acre-feet. The water surface area would be about 1,500 acres, and the normal pool elevation would be 5,588 feet.

The dam would be of rockfill construction with an impervious earth core. It would have a height of 119 feet and a crest length of 925 feet.

The outlet to the stream channel below the dam would consist of a welded steel pipe located in the right abutment of the dam. Releases through a submerged intake structure would be controlled by two hydraulically operated gate valves. A regulating valve would be located on the downstream end of the pipe.

A side channel spillway would be located in the right abutment of the dam. At the maximum water surface elevation of 5,524 feet, spillway discharge capacity would be about 5,700 second-feet and surcharge storage capacity would be about 7,000 acre-feet. The spillway would consist of an uncontrolled overflow weir, with an unlined chute discharging into the stream channel below the dam. The concrete ogee weir section would be 106 feet in length, and the chute would vary in width from 10 to 20 feet.

Pertinent data with respect to general features of the Frenchman Project as designed for cost estimating purposes are presented in Table 6.

Bedrock at the Frenchman dam site is hard, fresh, massive andesite, except in an area high on the left abutment where the foundation consists of an andesitic mudflow. Results of exploratory drilling indicate that a minimum of abutment stripping and only light grouting would be required. The average depth of

TABLE 6

GENERAL FEATURES OF FRENCHMAN PROJECT

Frenchman Dam

Type	rockfill
Crest elevation, in feet	5,600
Crest length, in feet	925
Crest width, in feet	25
Height, spillway lip above stream bed, in feet	107
Side slopes, upstream	2:1
downstream	1.75:1
Freeboard above spillway lip, in feet	12
Elevation of stream bed, in feet	5,481
Elevation of normal pool, in feet	5,588
Volume of fill, in cubic yards	350,600

Frenchman Reservoir

Surface area at spillway lip, in acres	1,500
Storage capacity at spillway lip, in acre-feet	50,000
Drainage area, in square miles	88
Estimated average annual runoff, in acre-feet	27,000
Estimated new yield, in acre-feet per season	12,000
Type of spillway---unlined side channel in right abutment with uncontrolled overflow weir	
Spillway discharge capacity, in second-feet	5,700
Type of outlet--36-inch diameter welded steel pipe beneath dam	

Main Canal

Natural channels of Little Last Chance Creek

Service Area

Last Chance Creek Water District in Sierra Valley	
Area to receive a full irrigation supply, in acres	6,700

alluvial fill in the channel is about 10 feet. The dam site is considered adequate to support a dam of the proposed height.

Exploration of potential borrow area and materials testing have revealed that ample quantities of construction materials suitable for use in an impervious core for the dam may be obtained within 1 mile of the site. Rock for the dam fill may be quarried at the site.

A topographic map of the reservoir area at a scale of 1 inch equals 400 feet was made by the United States Bureau of Reclamation in 1946. The dam site was mapped at a scale of 1 inch equals 100 feet by a firm under contract to the Department of Water Resources during this investigation.

Rights of way necessary for the dam and reservoir would involve the acquisition of privately owned land and the use of federally owned land. The majority of the area is dry pasture land with some irrigated pasture in the bottom lands. Brush and some small trees are scattered on the slopes, and moderate to good crops of native grasses grow in the meadows during the spring and early summer months.

Approximately 3.7 miles of gravelled Forest Service road would require relocation.

It was assumed that the recreational development for the project would consist of both publicly owned and privately owned facilities. However, in determining project benefits from recreation, only the visitor-days use of publicly owned facilities was estimated.

Project Water Yield

A large portion of the flow of Little Last Chance Creek is presently diverted for irrigation use on adjacent meadow lands. However, the method of application and the unfavorable time of occurrence of the natural flow results in an inefficient operation; only a small percentage of the applied water is beneficially used by growing crops. Regulation of the stream flow would make possible a substantial increase in the amount of water which could be put to

beneficial use. This increase was considered to be the new yield of the Frenchman Project. An estimate of the amount of water beneficially used under present conditions was prepared. For this purpose, stream flows were considered usable to the extent of consumptive requirements and irrecoverable losses in areas presently irrigated. This present beneficial use was found to vary from less than 2,000 acre-feet to more than 8,000 acre-feet per season, the average being about 4,000 acre-feet. The estimated new seasonal yield of the Frenchman Project was therefore the total yield minus the 4,000 acre-feet, which represents the average seasonal use under present conditions.

The availability of irrigation water under project conditions, as compared to present conditions, is presented in Table 7.

TABLE 7
ESTIMATED BENEFICIAL USE OF IRRIGATION WATER,
FRENCHMAN PROJECT SERVICE AREA

(In acre-feet)

	October-	:	:	:	:	:	Sep-	:
	March	April	May	June	July	August	tember	Total
Pre-project	0	500	1,600	1,100	400	300	100	4,000
Project	0	100	900	3,500	5,200	4,500	1,800	16,000*
New Yield								12,000

* Reflects a 50 per cent deficiency in 1 year of a 45-year period, with an average seasonal deficiency of 2 per cent.

Economic Justification

Economic justification of the Frenchman Project was based on a comparison of primary benefits with costs.

Primary Benefits

Benefits from construction and operation of the Frenchman Project would accrue from regulation of the water for irrigation use in Sierra Valley, from flood protection downstream, and from recreational enhancement. The average annual net irrigation benefit was estimated to be about \$108,000. This amount was based on a net annual benefit of \$9 per acre-foot of new water that would be developed by the project for use in Sierra Valley. The average annual primary flood control benefit was estimated to be about \$3,000, and the average annual recreational benefit, based on at-site use of public facilities, was estimated to be about \$50,000. As previously stated, stream flow maintenance benefits below the dam would be negligible.

The average annual benefits that would accrue from construction of the Frenchman Project are summarized in Table 8.

TABLE 8
ESTIMATED AVERAGE ANNUAL NET BENEFITS,
FRENCHMAN PROJECT

Item	Benefit
Irrigation	\$107,600
Flood control	2,600
Recreation	<u>49,900</u>
TOTAL	\$160,100

The development of local water supplies to provide supplemental water to irrigable lands in Sierra Valley would also result in significant secondary benefits, due to stimulus to the local economy. In addition, other secondary benefits would accrue from

flood control protection and from an increase in recreational activity and income.

Costs

The estimates of capital and average annual costs of the Frenchman Project, required for the purpose of determining economic justification, included costs of the following: (1) construction of the dam and appurtenances; (2) lands, easements, rights of way, and relocation of public utilities; (3) construction of public recreation facilities and access roads; and (4) operation, maintenance, and administration. A 3 per cent per annum interest rate was used in deriving the annual costs.

The estimated capital cost of the Frenchman Project would be \$1,695,000. This figure includes the present worth of initial and estimated future expenditures for public recreation facilities during the 50-year repayment period of the project. The estimated initial expenditure for public recreation facilities would be \$62,500, resulting in a total initial capital cost for the project of \$1,532,000.

The total average annual cost of the Frenchman Project was determined to be \$89,000.

Capital and annual costs for features of the Frenchman Project are summarized in Table 9. Detailed costs are presented in Appendix B.

Benefit-Cost Ratio

The resulting ratio of benefits to costs for the Frenchman Project would be 1.8 to 1.

TABLE 9

ESTIMATED COSTS OF FRENCHMAN PROJECT

Item	Capital cost	Annual cost			Total
		Interest and payment	Operation, maintenance, and replacement		
Frenchman Dam and appurtenances	\$ 885,000	\$34,000	\$11,000		\$45,000
Lands, easements, rights of way, and relocation of public utilities	584,000	23,000			23,000
Public recreation facilities	<u>226,000</u>	<u>9,000</u>	<u>12,000</u>		<u>21,000</u>
TOTALS	\$1,695,000	\$66,000	\$23,000		\$89,000

Cost Allocation

Of the total costs of the project, those for lands, easements, rights of way, and relocation of public utilities were assumed to be a responsibility of the State. The remaining costs, amounting to \$66,300, were allocated by the Separable Costs-Remaining Benefits Method to irrigation and recreation purposes. These allocated costs were reduced to a common-time basis, and were expressed as average annual costs. The cost allocation is shown in Table 10.

Results of the cost allocation indicated that the total reimbursable cost which should be assumed by the water users would amount to \$30,200. The unit annual cost of new irrigation water, on the basis of the allocation, would be \$2.50 per acre-foot of new water.

The cost allocation also indicated that the annual cost of the recreation features of the Frenchman Project would amount to \$36,100. For purposes of this report, these features were considered

TABLE 10

ALLOCATION OF ANNUAL COSTS OF FRENCHMAN PROJECT

Item of annual benefits or cost	: Irriga- : tion	: Recre- : ation	: Total
Benefits	\$107,600	\$49,900	\$157,500
Alternative single-purpose cost	45,400	53,200	98,600
Benefits limited by alternative cost	45,400	49,900	95,300
Separable costs	13,100	20,900	34,000
Remaining benefits	32,300	29,000	61,300
Unallocated joint costs			32,300
Allocated joint costs	17,100	15,200	32,300
Total allocation	30,200	36,100	66,300

to be of general state-wide interest and, therefore, their costs were assumed to be nonreimbursable.

Proposed Method of Financing

For purposes of this investigation, it was assumed that sufficient funds would be made available to the constructing agency for the construction of initial features of the project. In addition, it was assumed that some provision would be made for future construction of recreation facilities as they might become necessary. It was further assumed that the reimbursable costs allocated to irrigation use would be repaid from sales of water to the Last Chance Creek Water District.

Conclusions

The following conclusions with reference to the Frenchman Project are based on results of the engineering, geologic, and economic investigations and studies.

1. The project would be an engineeringly practicable means of developing the waters of Little Lost Chance Creek for supplemental irrigation use in Sierra Valley.
2. The project would have a benefit-cost ratio of 1.8 to 1 and, therefore, would be economically justified.
3. The irrigation benefits would provide direct economic gain to the water users. Therefore, in accordance with the criteria adopted for this study, the irrigation costs were considered to be reimbursable by the beneficiaries.
4. The ability of water users to pay the annual cost of irrigation water would exceed the cost of that water.
5. The recreation benefits would be of state-wide interest and, therefore, in accordance with the criteria adopted for this study, the costs for this purpose were assumed to be a responsibility of the State and nonreimbursable.

Recommendations

For the Frenchman Project it is recommended:

1. That a public hearing be held to determine the willingness of prospective water users to pay for project water.
2. That funds in the amount of \$556,000 be appropriated for purchase of lands, easements, rights of way, for relocation of public utilities, and for final design and preparation of specifications, provided that reasonable assurance be obtained that the water users will assume the obligation for repayment of reimbursable costs.

GRIZZLY VALLEY PROJECT

The Grizzly Valley Project is a proposed reservoir and system of works to regulate the waters of Big Grizzly Creek for irrigation use in Sierra Valley, and to form the basis for enhancement of an outdoor recreation area. Its operation would provide a regulated water supply of about 15,100 acre-feet seasonally, of which 14,900 acre-feet would be new water that is presently unavailable to irrigators in the valley.

The project would include Grizzly Valley Reservoir, which would enhance the recreational setting and provide an opportunity for the construction of camp sites, boating facilities, and summer homes. Both the area surrounding the reservoir and the canyon downstream would be desirable for this type of development. Although the reservoir would detain and reduce peak flood flows, relatively little damage presently occurs to private or public structures, so that only minor flood control benefits would be realized by construction of the project.

Plan of Development

The Grizzly Valley Project would consist of Grizzly Valley Reservoir, formed by a dam on Big Grizzly Creek about 5 miles north of Portola, a main conveyance canal to deliver water to Sierra Valley, and basic recreational facilities and access roads. The existing stream channel of Big Grizzly Creek, from the dam site downstream to the pond at Walton's Grizzly Lodge, would be utilized as part of the water distribution conduit. From the pond at the lodge, a canal would extend eastward along the northern edge of Sierra Valley for a distance of about 17 miles to its terminus in

the Middle Fork of the Feather River. A portion of the service area could be served from the canal and another portion served by diversion from the Middle Fork of the Feather River below the point of discharge.

Features of the Grizzly Valley Project and the service area are shown on Plate 3.

Service Area

The service area for the Grizzly Valley Project would consist of a portion of the existing Last Chance Creek Water District, and the valley area immediately north of the district. Operation of the project would be integrated with operation of the Frenchman Project. At present the area outside the water district is dry-farmed, while that within the district receives some irrigation water, most of which is available only in the early spring. It was estimated that approximately 6,200 acres could receive a full irrigation water supply from the Grizzly Valley Project. Study may indicate that in connection with the project it would be desirable to include additional lands within the existing water district.

General Features of Project

Grizzly Valley Reservoir would have a gross storage capacity of 80,000 acre-feet, and a net storage capacity of 77,800 acre-feet. The water surface area would be about 4,100 acres, and the normal pool elevation would be 5,775 feet.

The dam would be of earthfill construction. It would have a height of 123 feet, and a crest length of 380 feet.

*Grizzly Valley
Reservoir Area*



*Sierra Valley
Service Area of
Grizzly Valley and
Frenchman Projects*



A concrete-lined chute spillway would be located in the right abutment of the dam. At the maximum water surface elevation of 5,780 feet, spillway discharge capacity would be about 3,100 second-feet and surcharge storage capacity would be about 14,000 acre-feet. The spillway would have a concrete ogee control weir with a length of 75 feet, and would discharge into the stream channel below the dam.

The distribution conduit from the pond at Walton's Grizzly Lodge would consist of an asphalt-lined canal, 16.6 miles in length, with an initial capacity of 87 second-feet, reduced to 17 second-feet at its terminus. Water surface elevation at the canal headworks would be 4,947 feet, and at the point where the water discharges into the Middle Fork of the Feather River the water surface elevation would be 4,897 feet. The outlet at the pond would consist of a concrete inlet structure containing three 4 x 3 foot headgates, constructed on the upstream face of the dam. An opening through the left end of the existing dam forming the pond would connect to 600 lineal feet of flume which would discharge into the distribution canal.

Pertinent data with respect to general features of the Grizzly Valley Project as designed for cost estimating purposes are presented in Table 11.

Bedrock at the Grizzly Valley dam site is a jointed granodiorite which outcrops nearly continuously along both abutments. Occasional andesitic dikes cut the granodiorite in the area of the dam site. Several joint sets are prominent. Gouge is developed along some shear zones. Talus on the abutments and fill in the channel are thin, but heavy excavation to shape the steep rocky

TABLE 11

GENERAL FEATURES OF GRIZZLY VALLEY PROJECT

Grizzly Valley Dam

Type	earthfill
Crest elevation, in feet	5,786
Crest length, in feet	380
Crest width, in feet	25
Height, spillway lip above stream bed, in feet	112
Side slopes, upstream	2:1 and 3:1
downstream	2:1
Freeboard above spillway lip, in feet	11
Elevation of stream bed, in feet	5,663
Elevation of normal pool, in feet	5,775
Volume of fill, in cubic yards	230,800

Grizzly Valley Reservoir

Surface area at spillway lip, in acres	4,100
Storage capacity at spillway lip, in acre-feet	80,000
Drainage area above dam site, in square miles	45
Estimated average annual runoff, in acre-feet	25,000
Estimated new yield, in acre-feet per season	15,000
Type of spillway--lined chute in the right abutment with concrete control weir	
Spillway discharge capacity, in second-feet	3,100
Type of outlet--42-inch diameter welded steel pipe beneath dam	

Diversion Works

Existing concrete slab and buttress dam at Walton's Grizzly Lodge, 175 feet in length, and 37 feet in height above stream bed, crest elevation, 5,052 feet	
Type--buried asphalt membrane	
Length, in miles	16.6
Capacity, in second-feet	87 to 17

Service Area

Sierra Valley	
Area to receive a full irrigation supply, in acres	6,200

abutments may be required. The foundation is considered adequate to support a dam of the height proposed.

Large deposits of lake sediments for use as impervious fill are located within 0.25 mile of the site. Decomposed granodiorite located on the left abutment above the dam site is suitable for use in the dam fill. Rock for riprap can be quarried at the site.

A topographic map of the reservoir area at a scale of 1 inch equals 400 feet was made by the United States Bureau of Reclamation in 1946. The dam site was mapped at a scale of 1 inch equals 100 feet by a firm under contract to the Department of Water Resources during this investigation.

To secure rights of way necessary for the dam and reservoir and conduit would involve the acquisition of privately owned land and the use of federally owned land. The majority of the land is utilized for dry pasture, with brush and some small trees scattered over the slopes. Moderate crops of native grasses grow in the meadows during the spring and early summer months.

Approximately 3.5 miles of gravelled county road would require relocation.

It was assumed that the ultimate recreational development for the project would consist of both publicly owned and privately owned facilities. It would include summer homes located at considerable distance from the water along the eastern shore line of the reservoir; resort areas, including retail stores, motels, and boating facilities, along both sides of the reservoir; and public camp sites in the area immediately west of the reservoir. The latter area would also include two commercial developments.

The recreation facilities proposed for immediate development would consist of access roads, basic public utilities, and a camp site area. Although it was assumed that the recreational development for the project would consist of both publicly owned and privately owned facilities, in determining project benefits from recreation, only the visitor-days of use of publicly owned facilities was estimated.

Project Water Yield

Big Grizzly Creek joins the Middle Fork of the Feather River just downstream from the outlet of Sierra Valley. Therefore, except for a few hundred acre-feet of water per season that is presently used in an area adjacent to Big Grizzly Creek, none of the waters of Big Grizzly Creek are used for irrigation. Construction of the Grizzly Valley Project would make available 14,900 acre-feet of new water seasonally for irrigation use in Sierra Valley.

The estimated seasonal distribution of new water that would be made available by the project is presented in Table 12.

TABLE 12

PROPOSED SEASONAL DISTRIBUTION OF IRRIGATION WATER, GRIZZLY VALLEY PROJECT

(In acre-feet)

October-	:	:	:	:	:	Sep-	:
March	:	May	:	June	:	July	:
	:		:		:	August	:
	:		:		:	tember	:
	:		:		:		Total
0		500		3,100		5,100	
						4,500	
						1,800	
							15,000

Economic Justification

Economic justification of the Grizzly Valley Project was based on a comparison of primary benefits with costs.

Primary Benefits

Benefits from construction and operation of the Grizzly Valley Project would accrue from the regulation of water for irrigation use in Sierra Valley and from recreational enhancement. It was estimated that the average annual net primary irrigation benefits would be about \$134,000. This amount was based on a net annual

benefit of \$9 per acre-foot of new water that would be developed by the project for use in Sierra Valley. The average annual net recreation benefits, based on at-site use of public facilities, were estimated to be about \$59,000. As previously stated, flood control benefits would be negligible, as would stream flow maintenance benefits below the dam.

The average annual benefits that would accrue from construction of Grizzly Valley Project are summarized in Table 13.

TABLE 13
ESTIMATED AVERAGE ANNUAL NET BENEFITS,
GRIZZLY VALLEY PROJECT

Item	:	Benefit
Irrigation		\$134,100
Recreation		<u>59,400</u>
TOTAL		<u>\$193,500</u>

The development of local water supplies to provide supplemental water to irrigable lands in Sierra Valley would also result in significant secondary benefits, from the stimulus to the local economy. In addition, other secondary benefits would accrue from an increase in recreational activity and income.

Costs

The estimates of capital and average annual costs of the Grizzly Valley Project, required for the purpose of determining economic justification, included costs of the following: (1) construction of the dam and appurtenances; (2) construction of the main canal from Big Grizzly Creek to the service area; (3) land, easements, and

rights of way, and relocation of public utilities; (4) construction of public recreation facilities and access roads; and (5) operation, maintenance, and administration. A 3 per cent per annum interest rate was used in deriving the annual costs.

The estimated capital cost of the Grizzly Valley Project would be \$1,900,000. This figure includes the present worth of initial and estimated future expenditures for public recreation facilities during the 50-year repayment period of the project. The estimated initial expenditure for public recreation facilities would be \$71,000, resulting in a total initial capital cost for the project of \$1,716,000.

The total average annual cost of the Grizzly Valley Project was determined to be \$107,000.

Capital and annual costs for features of the Grizzly Valley Project are summarized in Table 14. Detailed costs are presented in Appendix B.

TABLE 14
ESTIMATED COSTS OF GRIZZLY VALLEY PROJECT

Item	Capital cost	Annual cost		
		Interest: and re- payment	Operation, mainte- nance, and replacement	Total
Grizzly Valley Dam and appurtenances	\$ 568,000	\$22,000	\$13,000	\$ 35,000
Main canal	729,000	28,000	6,000	34,000
Lands, easements, rights of way, and relocation of public utilities	348,000	14,000		14,000
Public recreation facilities	<u>255,000</u>	<u>10,000</u>	<u>14,000</u>	<u>24,000</u>
TOTALS	\$1,900,000	\$74,000	\$33,000	\$107,000

Benefit-Cost Ratio

The resulting ratio of benefits to costs for the Grizzly Valley Project would be 1.8 to 1.

Cost Allocation

Of the total costs of the project, those for lands, easements, rights of way, and relocation of public utilities were assumed to be a responsibility of the State. The remaining costs, amounting to \$93,500, were allocated by the Separable Costs-Remaining Benefits Method to irrigation and recreation purposes. These allocated costs were reduced to a common-time basis, and were expressed as average annual costs. The cost allocation is shown in Table 15.

TABLE 15

ALLOCATION OF ANNUAL COSTS OF GRIZZLY VALLEY PROJECT

Item of annual benefit or cost	: :	Irri- gation	: :	Recre- ation	: :	Total
Benefits		\$134,100		\$59,400		\$193,500
Alternative single-purpose cost		69,300		44,600		113,900
Benefits limited by alternative cost		69,300		44,600		113,900
Separable costs		48,900		24,200		73,100
Remaining benefits		20,400		26,400		46,800
Unallocated joint costs						20,400
Allocated joint costs		10,200		10,200		20,400
Total allocation		59,100		34,400		93,500

Results of the cost allocation indicated that the total annual reimbursable cost which should be assumed by the water users

would amount to \$59,100. The unit annual cost of irrigation water, on the basis of the allocation, would be \$4 per acre-foot of new water.

The cost allocation likewise indicated that the annual cost of the recreation features of the Grizzly Valley Project would amount to \$34,400. For purposes of this report, these features were considered to be of general state-wide interest and, therefore, their costs were assumed to be nonreimbursable.

Proposed Method of Financing

For purposes of this investigation, it was assumed that sufficient funds would be made available to the constructing agency for the construction of initial features of the project. In addition, it was assumed that some provision would be made for future construction of recreation facilities as they might become necessary. It was further assumed that the reimbursable costs allocated to irrigation use would be repaid from sales of water to an expanded Last Chance Creek Water District.

Conclusions

The following conclusions with reference to the Grizzly Valley Project are based upon results of the engineering, geologic, and economic investigations and studies.

1. The project would be an engineeringly practicable means of developing the waters of Big Grizzly Creek for supplemental irrigation use in Sierra Valley.
2. The project would have a benefit-cost ratio of 1.8 to 1, and, therefore, would be economically justified.
3. The irrigation benefits would provide direct economic gain to the water users. Therefore, in accordance with the criteria adopted for this study, the irrigation costs were considered to be reimbursable by the beneficiaries.

4. The ability of water users to repay the annual cost of irrigation water would exceed the cost of that water.

5. The recreation benefits would be of state-wide interest and, therefore, in accordance with the criteria adopted for this study, the costs of this purpose were assumed to be a responsibility of the State and nonreimbursable.

Recommendations

For the Grizzly Valley Project it is recommended:

1. That a public hearing be held to determine the willingness of prospective water users to pay for project water.

2. That funds in the amount of \$387,000 be appropriated for purchase of lands, easements, rights of way, for relocation of public utilities, and for final design and preparation of specifications, provided that reasonable assurance be obtained that the water users will assume the obligation for repayment of reimbursable costs.

CHAPTER IV. ALTERNATIVE GRIZZLY VALLEY RECREATION PROJECT

Grizzly Valley Reservoir was also studied from the standpoint that it would be operated principally as a recreation project. Water stored in the reservoir on Big Grizzly Creek could be regulated and released to maintain the flow of the Middle Fork of the Feather River rather than being used for irrigation in Sierra Valley. A firm controlled flow would aid in developing the recreational potential of 33 miles of attractive natural stream channel, and provide the basis for an increase in angling use. The reservoir itself would provide a setting for the development of recreational facilities. In addition, the project would provide regulated water for the production of hydroelectric power at several proposed downstream power plants, including the power plants below Oroville Reservoir.

Project Area

The Middle Fork of the Feather River drains a mountainous area in northern Sierra and southern Plumas Counties almost wholly within the Plumas National Forest. The principal benefits from a stream flow maintenance program on the Middle Fork would be realized along the stretch of river from Portola to the vicinity of Sloat. Along this reach, through Humbug, Mohawk, and Long Valleys, the stream is particularly attractive and easily accessible. Downstream from Sloat the river drops through a precipitous canyon where access is difficult and where recreational use would therefore be limited.

Climate

The predominating features of the climate of Plumas and Sierra Counties have previously been discussed. As stated, the winters are moderately severe, but the summers are warm and exceedingly pleasant.

Land Use

Nearly all of the mountain and hill land in the Middle Fork of the Feather River Basin is presently owned and managed by the United States Forest Service for timber production, wildlife, grazing of livestock, recreation, and water production. The land is largely in its natural state. On the other hand, most of the valley land is privately owned.

Population

A total of four communities, Portola, Clio, Blairsden, and Sloat, are located along the Upper Middle Fork, ranging in size from less than fifty to several thousand inhabitants. These communities would be directly affected by construction of the Alternative Grizzly Valley Recreation Project. It is estimated that there are over 100 inhabitants living in the project area.

Transportation

The highway and railroad routes through the Feather River country follow the Middle Fork of the Feather River in the higher elevations. Both U. S. Highway 40 Alternate and the Western Pacific Railroad would provide access to the reach of the river that would be enhanced by the Alternative Grizzly Valley Recreation Project.

*Antelope Valley
Reservoir Area*



*Middle Fork
Feather River
Below Grizzly
Valley Reservoir*

Need for Project Development

A significant increase in use of the outdoor recreation and fishing potential of the Middle Fork of the Feather River would be realized by regulation of the stream flow. As has been stated, runoff from streams in the basin, formed largely from melting snows, occurs as torrential floods in the spring, but drops sharply to minimum flows soon thereafter.

Because of the natural scenic beauty of the tree-covered slopes and mountain meadows, the Middle Fork receives considerable recreational use at present. People from throughout California travel to the area to fish, hunt, and vacation along the river. Development of the waters of Big Grizzly Creek for stream flow maintenance in the Middle Fork would provide opportunity for a greater expansion of the recreational activities. Public and private facilities could be developed along the stream after improvement of its flow by operation of the headwater reservoir.

Plan of Development

Grizzly Valley Reservoir, if utilized for recreational purposes, would be constructed in Grizzly Valley, with the dam located on Big Grizzly Creek about 5 miles north of Portola. It was estimated that an additional average annual total of 39,400 visitor-days of use would be realized from developments around the lake, and about 323,000 visitor-days from the stream flow maintenance program. Features of the Alternative Grizzly Valley Project are shown on Plate 3.

General Features of Project

Grizzly Valley Reservoir, planned as a recreation project, would have a gross storage capacity of 44,000 acre-feet and a net capacity of 43,000 acre-feet. The water surface area would be about 2,700 acres, and the normal pool elevation would be about 5,763 feet.

The dam would be of earthfill construction, with a height of 101 feet and a crest length of 315 feet.

A concrete-lined chute spillway would be located in the left abutment of the dam. At the maximum water surface elevation of 5,767.5 feet, spillway discharge capacity would be about 2,465 second-feet, and surcharge storage capacity would be about 12,000 acre-feet. The spillway would have a concrete ogee control weir with a length of about 75 feet, and would discharge into the stream channel below the dam.

Pertinent data with respect to general features of the Alternative Grizzly Valley Recreation Project as designed for cost estimating purposes are presented in Table 16.

Geologic characteristics of the foundation are the same for this structure as for the larger Grizzly Valley Reservoir proposed for irrigation use. Details are discussed in Chapter III.

The ultimate recreational development planned for the lake area would consist of both public and private facilities. In determining project benefits from recreation, however, the visitor-days use of only publicly owned facilities were considered.

The proposed ultimate plan of development includes summer homes located a considerable distance from the water along the eastern shore line of the reservoir. Resort areas, including retail stores, motels, and boating facilities would be constructed on both sides of

TABLE 16

GENERAL FEATURES OF ALTERNATIVE
GRIZZLY VALLEY RECREATION PROJECT

Grizzly Valley Dam

Type	earthfill
Crest elevation, in feet	5,774
Crest length, in feet	315
Crest width, in feet	25
Height, spillway lip above stream bed, in feet	90
Side slopes, upstream	2:1 and 3:1
downstream	2:1
Freeboard above spillway lip, in feet	11
Elevation of stream bed, in feet	5,673
Elevation of normal pool, in feet	5,763
Volume of fill, in cubic yards	153,700

Grizzly Valley Reservoir

Surface area at spillway lip, in acres	2,700
Storage capacity at spillway lip, in acre-feet	44,000
Drainage area above dam site, in square miles	45
Estimated average annual runoff, in acre-feet	25,000
Estimated stream flow maintenance, at Middle Fork Feather River at Clio, minimum flow, in second-feet.	50
Type of spillway--lined chute in the left abutment with concrete control weir	
Spillway discharge capacity, in second-feet.	2,465
Type of outlet--30-inch diameter pipe beneath dam	

the reservoir. Camp sites, together with two commercial developments, would be located in an area immediately west of the reservoir. The initial development would consist of access roads, basic public utilities, and a camp site area, all of which was assumed would be constructed with public funds. As the demand for facilities increased, private development would be encouraged.

Specific developments along the Middle Fork of the Feather River from Portola to Sloat were not planned. It was anticipated that public access to the stream would be maintained, but, otherwise, the physical structures would be privately owned. Project benefits were derived from an estimated increase in fishing use of the stream.

Project Water Yield

Grizzly Valley Reservoir, if operated to maintain stream flow in the Middle Fork of the Feather River by combining releases with the natural outflow from Sierra Valley, would assure a minimum flow in the Middle Fork at Portola of 50 second-feet.

Monthly flows in the Middle Fork of the Feather River at the gaging station near Clio for the critical dry year of record, 1931, as compared with flows that would have occurred with the project in operation, are presented in Table 17.

Economic Justification

Economic justification of the Alternative Grizzly Valley Recreation Project was based on a comparison of primary benefits with economic costs.

TABLE 17

COMPARISON OF FLOWS IN MIDDLE FORK FEATHER RIVER, WITH AND WITHOUT ALTERNATIVE GRIZZLY VALLEY RECREATION PROJECT, FOR CRITICAL DRY YEAR OF 1931

(In second-feet)

Con- dition	Average monthly flow											
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Pre-project	91	108	207	72	63	26	11	8	10	18	22	56
Project	90	99	159	53	69	50	50	50	50	50	50	66

Primary Benefits

Benefits accruing from construction of the Alternative Grizzly Valley Recreation Project would result from the recreational enhancement of the area. The estimated average annual net benefits, based on the use of public facilities around the reservoir, would be about \$59,000. Based on anticipated increased use of the improved Middle Fork for fishing, an additional average annual net benefit of about \$719,000 would result. The total average annual benefits accruing from operation of Grizzly Valley Reservoir for recreational purposes would be \$778,000. Average annual benefits that would accrue from construction of the Alternative Grizzly Valley Recreation Project are presented in Table 18.

TABLE 18

ESTIMATED AVERAGE ANNUAL NET BENEFITS,
ALTERNATIVE GRIZZLY VALLEY RECREATION PROJECT

Item	Benefit
Recreational enhancement of reservoir area	\$ 59,400
Stream flow maintenance program	<u>718,600</u>
TOTAL	\$778,000

Considerable secondary benefits to the area would accrue from the increased recreational activity. New business and additional income would stimulate and enhance the general economy.

Costs

The estimates of capital and average annual costs of the Alternative Grizzly Valley Recreation Project required for the purpose of determination of economic justification included costs of the following: (1) construction of the dam and appurtenances; (2) land, easements, and rights of way, and relocation of public utilities; (3) construction of public recreation facilities and access roads; and (4) operation, maintenance, and administration. A 3 per cent per annum interest rate was used in deriving the annual costs.

The estimated capital cost of the Alternative Grizzly Valley Recreation Project would be \$950,000. This figure includes the present worth of initial and estimated future expenditures for public recreation facilities during the 50-year period of analysis. The estimated initial expenditure for public recreation would be \$62,000, resulting in a total initial capital cost of \$758,000.

The total average annual cost of the Alternative Grizzly Valley Recreation Project was determined to be \$59,000.

Estimated capital and annual costs of features of the Alternative Grizzly Valley Recreation Project are itemized in Table 19. Detailed costs are presented in Appendix B.

TABLE 19

ESTIMATED COSTS OF
ALTERNATIVE GRIZZLY VALLEY RECREATION PROJECT

Item	Capital cost	Annual cost			Total
		Interest and re-payment	Operation, maintenance, and replacement		
Grizzly Valley Dam and appurtenances	\$348,000	\$14,000	\$ 7,000		\$21,000
Lands, easements, rights of way, and relocation of public utilities	348,000	14,000			14,000
Public recreation facilities	<u>254,000</u>	<u>10,000</u>	<u>14,000</u>		<u>24,000</u>
TOTALS	\$950,000	\$38,000	\$21,000		\$59,000

Benefit-Cost Ratio

The resulting ratio of benefits to costs for the Alternative Grizzly Valley Recreation Project would be about 13 to 1.

Cost Allocation

The uses of the Alternative Grizzly Valley Recreation Project would be of state-wide interest, and in accordance with the criteria adopted for this study, it was assumed that all costs would be borne by the State.

Public Policy Considerations

Although it has been shown that Grizzly Valley Reservoir could be operated as a recreation project to produce benefits in excess of costs, to do so would eliminate the possibility of serving potentially irrigable lands in Sierra Valley. It has long been a policy of the State that domestic use is the highest use and

irrigation is the next highest use of water. This policy is set forth in section 106 of Chapter 1 of Division 1 of the Water Code. Furthermore, in accordance with the policy set forth in section 10500 of Part 2 of Division 6 of the Water Code, full consideration must be given to the water needs of Sierra Valley as an area of origin. Sierra Valley is an inherently water-deficient area. It is believed that to deny this area the waters of Grizzly Creek would not be in the public interest. Therefore, further consideration of this alternative project should be contingent upon the acceptance or rejection of the Grizzly Valley project for irrigation use by water users in Sierra Valley.

Conclusions

The following conclusions with reference to the Alternative Grizzly Valley Recreation Project are based upon results of the engineering and geological investigations and economic studies.

1. The project would be an engineeringly practicable means of developing the waters of Big Grizzly Creek for recreation, fish, and wildlife purposes.

2. The project would have a benefit-cost ratio of 13 to 1 and, therefore, would be economically justified.

3. The recreation benefits would be of state-wide benefit. Therefore, in accordance with the criteria adopted for this study, the costs for this purpose were assumed to be a responsibility of the State and nonreimbursable.

4. The interests of the State would best be served by developing the waters of Big Grizzly Creek for irrigation use in Sierra Valley.

Recommendations

For the Alternative Grizzly Valley Recreation Project
it is recommended that:

Further consideration be given to the project only if it is found that prospective water users in Sierra Valley are unwilling to assume the obligation of repayment for the reimbursable costs of the Grizzly Valley Project.

CHAPTER V. INDIAN CREEK RECREATION PROJECT

The Indian Creek Recreation Project would be a major factor in development of the considerable recreational potential of the Upper Indian Creek Basin. The project would include three dams and reservoirs, to be operated for stream flow maintenance purposes, and to provide a setting for the development of recreational facilities around the reservoirs. In addition, the new water that would be obtained from the project would provide a supplemental water supply for irrigation use in Indian Valley.

Project Area

The Upper Indian Creek Basin is located in a mountainous area in northeastern Plumas County, almost wholly within the Plumas National Forest. The upper basin is defined as that portion of the Indian Creek Basin situated above Indian Valley. It is irregular in shape, with a maximum east-west length of about 30 miles, and an average north-south width of about 20 miles. It has a drainage area of about 550 square miles. The principal tributaries of Indian Creek in the upper basin are Last Chance and Red Clover Creeks.

Climate

The climate of the Upper Indian Creek Basin is quite similar to that of the Middle Fork Basin, although the average seasonal precipitation is somewhat greater. Precipitation varies from a low of 30 inches to a high of 50 inches, and more than half of that occurring between October and May is in the form of snow.

Other climatic characteristics are typical of the higher elevations of the Sierra Nevada, such as an abundance of sunshine,

wide range of temperature, and low humidity during the summer months.

Land Use

The major use of land in the Upper Indian Creek Basin is for timber production, and most of the land is owned and managed by the Federal Government. Agriculture is of importance, and consists of the raising of beef cattle, both on scattered privately owned and on federally owned lands. The grazing land is in its natural state, with tree-covered slopes and open meadow lands, and has a low cattle-carrying capacity. The grazing season extends from May through October, and irrigation is of minor importance in the operations.

In Indian Valley, the major use of land is for the production of beef cattle on improved range pasture. Here, irrigation is necessary for the maturation and successful production of crops. In accordance with the availability of natural runoff, meadow lands are irrigated by wild flooding, producing a high-quality hay for winter feeding. Several wells are operated to provide supplemental water for irrigation use. Some alfalfa and grain are produced in the valley, but additional water is needed in the late irrigation season for the maximum production of crops.

Population

The Upper Indian Creek Basin is sparsely inhabited, with permanent residents numbering less than a hundred. Several scattered logging and forestry camps experience an influx of workers during the summer season, but few remain during the winter months. None of the cattle-raising activities extend beyond the grazing season.

Transportation

An excellent transportation system extends to the project area. This includes U. S. Highway 40 Alternate, U. S. Highway 395, State Highway 89, and the Western Pacific's mainline railroad through the Sierra Nevada. Further development of the local road system would be needed in the project area. At present, this system includes a number of logging roads and several gravelled county roads that crisscross the area.

Need for Project Development

A significant increase in the outdoor recreation and fishing potential of the Upper Indian Creek Basin would be realized from regulation of the available water supplies. At present, runoff from streams in the basin, formed largely from melting snow, occurs as torrential floods in the spring, but drops sharply to a minimum flow soon thereafter.

Although it enjoys much natural scenic beauty, tree-covered slopes, and mountain meadows, the Upper Indian Creek Basin presently experiences only limited use as an outdoor recreation area. However, a limited number of people from throughout California do travel to the area to fish, hunt, camp, and vacation, for the area is readily accessible.

Plan of Development

The Indian Creek Recreation Project would comprise a system of works for regulating the waters of Indian Creek and its tributaries for the enhancement of recreation in the Upper Indian Creek Basin. The works would include Antelope Valley Dam and Reservoir on Indian

Creek, Dixie Refuge Dam and Reservoir on Last Chance Creek, Abbey Bridge Dam and Reservoir on Red Clover Creek, and public recreation facilities at each. In addition, the project would provide opportunity for the development of a large park and recreation area in Genesee Valley.

It was estimated that an average annual total of 93,200 visitor-days of use, over and above the present use, would be realized from developments proposed around the reservoirs. In addition, about 309,000 visitor-days of use would be realized from 62 miles of improved streams. Features of the project are shown on Plate 3.

General Features of Project

The following sections set forth more detailed descriptions of project features of Antelope Valley, Abbey Bridge, and Dixie Refuge Dams and Reservoirs.

Pertinent data with respect to the features of the Indian Creek Recreation Project as designed for cost estimating purposes are presented in Table 20.

Antelope Valley Dam and Reservoir. Antelope Valley Reservoir would be constructed in Antelope Valley, with the dam at a site on Antelope Creek about 1 mile downstream from the Boulder Creek Guard Station. An auxiliary dam would be constructed in a saddle about 300 feet west of the main dam.

The reservoir would have a gross storage capacity of 21,600 acre-feet and a net capacity of 18,300 acre-feet. The water surface area would be about 930 acres, and the normal pool elevation would be about 5,000 feet.

TABLE 20

GENERAL FEATURES OF INDIAN CREEK
RECREATION PROJECTAntelope Valley Dam

Type	earthfill
Crest elevation, in feet	5,016
Crest length, in feet	490
Crest width, in feet	25
Height, spillway lip above stream bed, in feet	77
Side slopes, upstream	2.5:1
downstream	2:1
Freeboard above spillway lip, in feet	16
Elevation of stream bed, in feet	4,923
Elevation of normal pool, in feet	5,000
Volume of fill, in cubic yards	182,200

Antelope Valley Auxiliary Dam

Type	earthfill
Crest elevation, in feet	5,016
Crest length, in feet	390
Crest width, in feet	25
Total height, in feet	29
Side slopes, upstream	2.5:1
downstream	2:1
Volume of fill, in cubic yards	19,000

Antelope Valley Reservoir

Surface area at spillway lip, in acres	930
Storage capacity at spillway lip, in acre-feet	21,600
Drainage area, in square miles	70
Estimated average annual runoff, in acre-feet	21,000
Estimated new yield, minimum flow, in second-feet	6
Type of spillway--unlined chute in the right abutment with concrete control weir	
Spillway discharge capacity, in second-feet	3,400
Type of outlet--24-inch diameter welded steel pipe beneath dam	

Dixie Refuge Dam

Type	earthfill
Crest elevation, in feet	5,751
Crest length, in feet	1,025
Crest width, in feet	25
Height, spillway lip above stream bed, in feet	70
Side slopes, upstream	2.75:1
downstream	2.25:1
Freeboard above spillway lip, in feet	11
Elevation of stream bed, in feet	5,670
Elevation of normal pool, in feet	5,740
Volume of fill, in cubic yards	319,300

TABLE 20 (Continued)

GENERAL FEATURES OF INDIAN CREEK
RECREATION PROJECTDixie Refuge Reservoir

Surface area at spillway lip, in acres	800
Storage capacity at spillway lip, in acre-feet	16,100
Drainage area, in square miles	46
Estimated average annual runoff, in acre-feet	13,000
Estimated new yield, minimum flow, in second-feet	8
Type of spillway--unlined saddle on left abutment with concrete control weir	
Spillway discharge capacity, in second-feet	2,250
Type of outlet--24-inch diameter welded steel pipe beneath dam	

Abbey Bridge Dam

Type	rockfill
Crest elevation, in feet	5,433
Crest length, in feet	645
Crest width, in feet	25
Height, spillway lip above stream bed, in feet	58
Side slopes, upstream	2:1
downstream	1.5:1
Freeboard above spillway lip, in feet	13
Normal bed elevation, in feet	5,362
Elevation of normal pool, in feet	5,420
Volume of fill, in cubic yards	95,800

Abbey Bridge Reservoir

Surface area at spillway lip, in acres	540
Storage capacity at spillway lip, in acre-feet	11,100
Drainage area, in square miles	89
Estimated average annual runoff, in acre-feet	24,000
Estimated new yield, minimum flow, in second-feet	12
Type of spillway--lined chute in right abutment with concrete control weir	
Spillway discharge capacity, in second-feet	7,750
Type of outlet--18-inch diameter welded steel pipe beneath dam	

The dam would be of earthfill construction, with a height of 93 feet and a crest length of 490 feet. The auxiliary dam would be of earthfill construction, with a height of 29 feet and a crest length of 390 feet.

An unlined chute spillway would be located across the right abutment of the dam. At a maximum water surface elevation of 5,011 feet, the spillway would have a maximum discharge capacity of 3,380 second-feet, and a surcharge storage capacity of about 8,400 acre-feet. The spillway would be constructed with an uncontrolled overflow weir section, and the chute would discharge into the stream channel below the dam. The concrete control weir would be 25 feet in length.

The outlet to the stream channel below the dam would consist of a welded steel pipe located in the left abutment of the dam. Releases through a submerged intake structure would be controlled by use of two hydraulically operated gate valves. A regulating valve would be located on the downstream end of the pipe.

Bedrock at Antelope Valley dam site is heavily jointed biotite hornblende granodiorite. That forming the left abutment is fresh, and outcrops continuously over the uniform slope. Very little stripping would be required. The right abutment is deeply weathered, with an irregular slope due to large unweathered blocks. Stripping would be deep under the impervious section of the dam. The channel is filled with upward of 15 feet of sand, gravel, and blocks. This fill would have to be removed to prepare for the impervious section of the dam.

The broad saddle behind the right abutment is underlain by decomposed granodiorite to a depth of over 30 feet. Removal of the root zone and treatment of the decomposed granite would be necessary

to prepare for the auxiliary dam. Considerable grouting would be required.

The results of exploratory drilling indicate that the site is suitable for the height of dam proposed.

Exploration of possible construction material borrow areas indicates that ample quantities of material for construction of an earthfill dam exist within 1.5 miles of the site.

A topographic map of the reservoir area at a scale of 1 inch equals 400 feet, and of the dam site at a scale of 1 inch equals 100 feet, was made by a firm under contract to the Department of Water Resources during this investigation.

To secure rights of way necessary for the dam and reservoir would involve the acquisition of privately owned land and the use of federally owned land. Most of the area is dry pasture land, with some irrigated pasture in the bottom lands. Timber grows on the slopes. Moderate-to-good crops of native grasses grow in the meadows during the spring and early summer months.

It was assumed that the recreational development for the project would consist of both publicly owned and privately owned facilities. However, in determining project benefits from recreation, only the visitor-days of use of publicly owned facilities were estimated. The facilities around the lake would consist of extensive family and organizational camps. Camp sites would be located on relatively flat wooded terrain with access to the lake frontage. The public beaches would be sandy and favorable to swimming. A pack station would be located near the westerly end of the reservoir and would accommodate parties into the Diamond Mountain country to the east. The primary commercial and resort area would be located along

*Abbey Bridge
Reservoir Area*



*Dixie Refuge
Reservoir Area*



the south shore. Summer homes would be scattered in small groups around the entire reservoir.

The development downstream along Indian Creek would consist of public campgrounds and picnic areas and associated recreational facilities. Some summer home areas and resort and commercial facilities would be developed.

Abbey Bridge Dam and Reservoir. Abbey Bridge Reservoir would be constructed on Red Clover Creek in the lower part of Red Clover Valley, with the dam at a site about 2 miles upstream from the Abbey Bridge Guard Station. The reservoir would have a gross storage capacity of 11,100 acre-feet and a net storage capacity of 10,100 acre-feet. The water surface area would be about 540 acres, and the normal pool elevation would be about 5,420 feet.

The dam would be of rockfill construction with an impervious earthen core. It would have a height of 71 feet and a crest length of 645 feet.

The outlet to the stream channel below the dam would consist of a welded steel pipe located in the right abutment of the dam. Releases through a submerged intake structure would be controlled by two hydraulically operated gate valves. A regulating valve would be located on the downstream end of the pipe.

A chute spillway would be located in a saddle on the right abutment of the dam. At maximum water surface elevation of 5,427.5 feet, it would have a discharge capacity of about 7,750 second-feet and a surcharge storage capacity of 5,100 acre-feet. The spillway would consist of an uncontrolled overflow weir, with a concrete-lined chute discharging into the stream channel below the dam. The concrete ogee weir section would be 100 feet in length.

Bedrock at Abbey Bridge dam site is a jointed, massive olivine hornblende basalt. In the spillway saddle the bedrock is in contact with porous andesitic mudflows. Stripping on the abutments under the impervious section of the dam would consist of about 5 feet of soil and bedrock. About 10 feet of debris and jointed bedrock would have to be removed from the channel. The dam site is considered adequate to support a dam of the height contemplated.

Rock for use in the dam as fill material could be quarried at the site. Also, talus slopes, located about 1 mile downstream, are a source of rockfill. Ample quantities of impervious material could be obtained from Red Clover Valley.

A topographic map of the reservoir area and dam site, at a scale of 1 inch equals 400 feet, was made by a firm under contract to the Department of Water Resources during this investigation.

To secure rights of way necessary for the dam, reservoir, and recreation facilities would involve the acquisition of privately owned land and the use of federally owned land. Most of the land is utilized for dry pasture, with brush and some small trees scattered over the slopes. Good crops of native grasses grow in the meadows during the spring and early summer months. Approximately 3.8 miles of gravelled county road would require relocation.

It was assumed that the recreational development for the project would consist of both publicly owned and privately owned facilities. However, in determining project benefits from recreation, only the visitor-days of use of publicly owned facilities were estimated. The facilities around the reservoir would consist of summer homes set back from the lake on both the north and south shores. A major resort would be located on the south shore near

the dam sites, and an additional resort could be developed near the middle of the north shore.

Camp areas would be located well back from the reservoir to provide a good view of the reservoir, adequate drainage, and to prevent pollution of the reservoir. The greatest concentration of development would probably take place near the westerly end of, and downstream from the reservoir.

The developments downstream along Red Clover Creek would consist of campgrounds and picnic areas and associated recreational facilities. Some summer home areas and resort and commercial facilities would be developed.

Dixie Refuge Dam and Reservoir. Dixie Refuge Reservoir would be constructed on Last Chance Creek, with the dam located about 5 miles south of Milford. The reservoir would have a gross storage capacity of 16,100 acre-feet and a net storage capacity of 14,150 acre-feet. The water surface area would be about 800 acres, and the normal pool elevation would be about 5,740 feet.

The dam would be of earthfill construction, with a height of 81 feet and a crest length of 1,025 feet.

The outlet to the stream channel below the dam would consist of a welded steel pipe located in the right abutment of the dam. Releases through a submerged intake structure would be controlled by two hydraulically operated gate valves. A regulating valve would be located on the downstream end of the pipe.

A chute spillway would be located in a saddle behind the left abutment of the dam. At maximum water surface elevation of 5,745.7 feet, it would have a discharge capacity of about 2,250 second-feet, and a surcharge storage capacity of about 5,100 acre-feet.

The spillway would consist of an uncontrolled overflow weir with an unlined chute discharging into the stream channel below the dam. The concrete ogee weir section would be 40 feet in length.

Bedrock at the Dixie Refuge dam site is biotite hornblende granodiorite. The depth of weathering is generally shallow, except for the terrace area on the right abutment. Stripping would be shallow, but it would be necessary to excavate a trench to assure a cutoff. Preliminary exploratory drilling indicates that the foundation is suitable to support a dam of the height contemplated.

The results of preliminary borrow exploration and materials testing indicate that an ample supply of material is available for construction of an earthfill dam.

A topographic map of the reservoir area at a scale of 1 inch equals 400 feet, and of the dam site at a scale of 1 inch equals 100 feet, was made by a firm under contract to the Department of Water Resources during this investigation.

To secure rights of way necessary for the dam, reservoir, and recreation facilities would involve the acquisition of privately owned land and the use of federally owned land. Most of the land is utilized for dry pasture, with brush and some small trees scattered over the slopes. Moderate crops of native grasses grow in the meadows during the spring and early summer months. Approximately 1.5 miles of gravelled county road, and 2 miles of power line would require relocation.

It was assumed that the recreational development for the project would consist of both publicly owned and privately owned facilities. However, in determining project benefits from recreation, only the visitor-days of use of publicly owned facilities was estimated.

The facilities around the lake would consist of camp sites in the higher elevations overlooking the reservoir along the north shore, with home sites closer to the reservoir. Two camp sites are proposed, one on the northwest shore close to the lake, and another larger area near the dam site.

The development downstream along Last Chance Creek would consist of campgrounds and picnic areas and associated recreational facilities. Some summer home areas and resort and commercial facilities would be developed.

Project Water Yield

The Indian Creek Recreation Project would be operated to provide releases from the reservoirs for stream flow maintenance purposes in Indian, Last Chance, and Red Clover Creeks. The three streams combine into a single stream at the upper end of Genesee Valley. The regulated flows would substantially enhance recreation from May through October. During the remainder of the year, the reservoir releases would be reduced by about one-half.

The relationship of average historical monthly stream flows during the minimum season of record, 1930-1931, as compared to average pre-project and project flow conditions, is presented in Table 21.

Economic Justification

Economic justification of the Indian Creek Recreation Project was based on a comparison of primary benefits with costs.

TABLE 21

COMPARISON OF FLOWS IN INDIAN, LAST CHANCE, AND
RED CLOVER CREEKS DURING MINIMUM DRY SEASON OF 1930-31
WITH AVERAGE PRE-PROJECT AND PROJECT FLOW CONDITIONS,
INDIAN CREEK RECREATION PROJECT

Condition	Average monthly flow, in second-feet											
	: Oct. :	Nov. :	Dec. :	Jan. :	Feb. :	Mar. :	Apr. :	May :	June :	July :	Aug. :	Sept. :
<u>Indian Creek</u>												
Estimated historical flow, 1930-31	2	4	4	7	14	18	9	4	1	1	1	1
Average pre-project	3	8	23	26	40	67	99	53	23	5	3	2
Project	9	5	12	19	26	54	89	47	19	9	9	9
<u>Last Chance Creek</u>												
Estimated historical flow, 1930-31	1	3	3	5	9	11	6	2	1	1	1	1
Average pre-project	2	5	14	16	25	42	62	33	15	3	2	1
Project	10	5	5	9	11	24	46	27	14	10	10	10
<u>Red Clover Creek</u>												
Estimated historical flow, 1930-31	7	8	7	12	20	34	22	18	0	0	1	3
Average pre-project	6	14	31	35	50	76	107	69	11	0	1	3
Project	13	7	15	23	32	67	101	65	17	13	13	13

Primary Benefits

The average annual net benefits from construction and operation of the Indian Creek Recreation Project would accrue from recreational enhancement of the reservoir area, estimated to amount to about \$146,000, and from stream flow maintenance for the enhancement of fish and wildlife, estimated to amount to about \$467,000. These estimates were based on a net benefit of \$2 per visitor-day of use. The benefits are summarized in Table 22.

The Indian Creek Recreation Project would also result in significant secondary benefits, by providing a stimulus to the local economy. These benefits, in general, would result from an increase in income to commercial establishments servicing the recreationists.

TABLE 22

ESTIMATED AVERAGE ANNUAL NET BENEFITS,
INDIAN CREEK RECREATION PROJECT

Unit	: Reservoir : area	:Stream flow : :maintenance :	Total
Antelope Valley Reservoir	\$ 53,000	\$ 86,000	\$139,000
Dixie Refuge Reservoir	42,000	242,000	284,000
Abbey Bridge Reservoir	<u>51,000</u>	<u>139,000</u>	<u>190,000</u>
TOTAL	\$146,000	\$467,000	\$613,000

Costs

The estimates of capital and average annual costs of the Indian Creek Recreation Project, required for the purpose of determining economic justification, include costs of the following:

(1) construction of the dam and appurtenances; (2) lands, easements, rights of way, and relocation of public utilities; (3) construction of public recreation facilities and access roads; and (4) operation, maintenance, and administration. A 3 per cent per annum interest rate was used in deriving the annual costs.

The estimated capital cost of the Indian Creek Recreation Project would be \$2,327,000. This figure includes the present worth of initial and estimated future expenditures for public recreation facilities during the 50-year repayment period of the project. The estimated initial expenditure for public recreation facilities would be \$266,000, resulting in a total initial capital cost for the project of \$1,925,000.

The total average annual cost of the Indian Creek Recreation Project was determined to be \$142,000.

Capital and annual costs for features of the Indian Creek Recreation Project are summarized in Table 23. Detailed costs are presented in Appendix B.

Benefit-Cost Ratio

The resulting ratio of benefits to costs for the Indian Creek Recreation Project would be 4.3 to 1.

Cost Allocation

It was considered that the recreational purposes and uses of the Indian Creek Recreation Project would be of general state-wide interest, and, therefore, in accordance with the criteria adopted for this study, all costs of the project were assumed to be borne by the State and nonreimbursable.

Proposed Method of Financing

It was assumed that the capital cost of the Indian Creek Recreation Project, estimated to be about \$1,925,000, would, in accordance with criteria adopted for this study, be financed by direct appropriation of the Legislature. Likewise, the costs of future additional public recreational units, and annual operation, maintenance, and replacement costs necessary to keep the project in operation, would be provided by legislative appropriations. A portion of these latter costs might be reduced by revenues from the project.

As has been previously stated, operation of this project for recreational purposes could so regulate the water supply presently utilized for irrigation in Indian Valley as to provide positive

TABLE 23

ESTIMATED COSTS OF INDIAN CREEK RECREATION PROJECT

Item	:	:	Annual costs	
			: Operation,	:
	Capital	Interest:	mainte-	
	cost	and re-	nance and	Total
	:	payment	replacement:	
Dams and appurtenances				
Antelope Valley	\$ 386,000	\$15,000	\$ 6,000	\$ 21,000
Abbey Bridge	433,000	17,000	4,000	21,000
Dixie Refuge	<u>555,000</u>	<u>22,000</u>	<u>5,000</u>	<u>27,000</u>
Subtotals	\$1,374,000	\$54,000	\$15,000	\$ 69,000
Lands, easements, rights of way, and relocation of public utilities				
Antelope Valley	\$ 93,000	\$ 4,000		\$ 4,000
Abbey Bridge	127,000	5,000		5,000
Dixie Refuge	<u>65,000</u>	<u>3,000</u>		<u>3,000</u>
Subtotals	\$ 285,000	\$12,000		\$ 12,000
Public recreation facilities				
Antelope Valley	\$ 228,000	\$ 9,000	\$13,000	\$ 22,000
Abbey Bridge	241,000	9,000	13,000	22,000
Dixie Refuge	<u>199,000</u>	<u>8,000</u>	<u>11,000</u>	<u>18,000</u>
Subtotals	\$ 668,000	\$26,000	\$37,000	\$ 63,000
TOTALS	\$2,327,000	\$92,000	\$52,000	\$144,000

benefits to the irrigation users. These benefits would be incidental to the main purpose of the project, and were omitted from the economic analysis.

Conclusions

The following conclusions with reference to the Indian Creek Recreation Project were based upon the results of the engineering, geologic, and economic investigation and studies.

1. The project would be an engineeringly practicable means of developing the waters of Indian Creek and its tributaries for recreation and fish and wildlife purposes.

2. The project would have a benefit-cost ratio of 4.3 to 1, and, therefore, would be economically justified.

3. The recreational benefits from the project would be of state-wide interest, and, in accordance with the assumed criteria, the costs should be the responsibility of the State and nonreimbursable.

Recommendations

In connection with the Indian Creek Recreation Project it is recommended that:

Funds in the amount of \$357,400 be appropriated for purchase of lands, easements, rights of way, for relocation of public utilities, and to provide for final design and preparation of specifications.

CHAPTER VI. SUMMARY OF POLICY ASSUMPTIONS,
CONCLUSIONS, AND RECOMMENDATIONS

In April, 1955, the Division of Water Resources issued a report entitled "Report on Upper Feather River Service Area". As a result of the findings of this report, and subsequent legislative hearings on the subject, the 1956 Session of the California Legislature made the following appropriations:

Item 223.1. "For completion of engineering and geological investigations, studies, and reports with recommendations for construction programs for multiple-purpose water development and flood control projects in the Upper Feather River Service Area, Division of Water Resources, Department of Public Works.\$385,000"

Item 419.6. "For acquisition of dam and reservoir sites for the following reservoirs, Water Project Authority . . . \$273,000 Grizzly Valley Reservoir on Big Grizzly Creek, Frenchman Reservoir on Little Last Chance Creek, Antelope Valley Reservoir on Indian Creek, Dixie Refuge Reservoir on Last Chance Creek, Abbey Bridge Reservoir on Red Clover Creek."

The Department of Water Resources, as successor to the Division of Water Resources and Water Project Authority, has had the responsibility of carrying out the intent of this legislation.

Sections of the Water Code which constitute general directives to the Department of Water Resources for the investigation of water resource developments such as those reported on herein include:

12581. "In studying water development projects, full consideration shall be given to all beneficial uses of the State's water resources, including irrigation, generation of electric energy, municipal and industrial consumption of water and power, repulsion of salt water, preservation and development of fish and wildlife resources, and recreational facilities, not excluding other beneficial uses of water, in order that recommendations may be made as to the feasibility of such projects and for the method of financing feasible projects."

12582. "Fish and wildlife values, both economic and recreational, shall be given consideration in any flood control or water conservation program. In the design, construction, and operation of projects, when engineering and economic features of the project make it practicable, adequate provisions shall be made for the protection of migratory fishes, and the designs for structures and facilities required for such protection shall be prepared in cooperation with the United States Fish and Wildlife Service and the California Department of Fish and Game."

Because important matters of policy relating to water resource developments have yet to be decided by the Legislature, it has been necessary to make certain assumptions with respect thereto, to assist in analyzing the projects reported on herein. The principal policy assumptions are summarized in the following paragraphs. This chapter also includes a brief recapitulation of the more significant conclusions resulting from the investigation, and contains recommendations for appropriate action.

Policy Assumptions

In order to evaluate the initial units of the Upper Feather River Basin Development as to their economic justification and financial feasibility, the following assumptions regarding as yet undetermined State policy have been made:

1. That economic justification and financial feasibility of those projects comprising the initial units of the Upper Feather River Basin Development would be evaluated individually and separately for each project. An evaluation of the effect of their possible future economic and/or financial integration with a comprehensive, basin-wide project or with the Feather River Project as a whole was not undertaken for this study.
2. That costs of lands, easements, rights of way, and relocation of public utilities necessary for the projects would be borne by the State as a nonreimbursable item.
3. That primary recreational benefits would be derived from use of public recreational facilities on reservoirs of the projects, and fishing in streams affected by the projects, and that these benefits can be expressed in monetary terms.
4. That costs of the projects incurred in the interests of recreation and fish and wildlife, including costs of minimum attendant public recreational facilities, which are of general state-wide interest, would be borne by the State as nonreimbursable items.
5. That increased costs of county and local district road improvements and maintenance resulting from recreational use of the projects, as well as losses in local tax revenue from lands for the projects acquired by the State, would be borne by local interests as part of their contribution to the projects.

6. That financial feasibility of project features proposed for irrigation purposes would be contingent upon a reasonable margin of profit to the purchaser of the irrigation water.

7. That the obligation for repayment of reimbursable costs would be borne by the water users and met over a 50-year period at a 3 per cent interest rate.

8. That costs of the projects incurred in the interest of providing flood control would be borne by the State or by the Federal Government as nonreimbursable items, but that allocation of costs would be made for flood control only when features of a project are specifically provided for flood control and where the flood control benefits are of significant magnitude.

9. That costs of the projects would be allocated to the various purposes by the Separable Costs-Remaining Benefits Method.

10. That an appropriate governmental agency, such as the State of California, would provide funds necessary for construction, operation, and maintenance of the projects, and would assume the role of creditor insofar as reimbursable costs are concerned.

Conclusions

As a result of the engineering, geologic, and economic surveys and studies during the current and prior investigations, the following conclusions have been reached:

1. The Frenchman Project, the Grizzly Valley Project or the Alternative Grizzly Valley Recreation Project, and the three units constituting the Indian Creek Recreation Project would be both engineeringly feasible and economically justified, either jointly or individually. Summaries of the general features, and of the benefits and costs of these projects, are presented in Tables 24 and 25, respectively.

2. Because of the rapidly expanding requirement for outdoor recreational opportunities in California and the established use of existing outdoor recreational facilities in the Upper Feather River Basin by people from throughout California, there is a general state-wide interest in and current need for the benefits to be derived from the recreational features of the foregoing projects.

3. Because of the limited and undependable water supply presently available for irrigation use and the possible expansion of irrigated agriculture if adequate water supplies can be made available in the Upper Feather River Basin, there is current need for the benefits to be derived from the irrigation features of the foregoing projects.

SUMMARY OF GENERAL FEATURES OF INITIAL UNITS OF UPPER FEATHER RIVER BASIN DEVELOPMENT

Item	Stream	Purpose	Dam and reservoir	Normal pool elevation	Storage capacity	Surface area	Type of dam	Height of dam	New seasonal yield	Service area
Frenchman Project	Little Last Chance Creek	Irrigation, flood control, recreation	Frenchman	5,586	50,000	1,525	Rock-fill	119	12,000	Sierra Valley
Grizzly Valley Project	Big Grizzly Creek	Irrigation, recreation	Grizzly Valley	5,775	80,000	4,100	Earth-fill	123	14,900	Sierra Valley
Alternative Grizzly Valley Recreation Project	Big Grizzly Creek	Recreation, stream maintenance	Grizzly Valley	5,763	44,000	2,700	Earth-fill	114	50	Middle Fork Feather River
	(Red Clover Creek)	Recreation, stream maintenance	Abbey Bridge	5,420	11,100	540	Rock-fill	71	12	Red Clover Creek
Indian Creek Recreation Project	(Indian Creek)	Recreation, stream maintenance	Antelope Valley	5,000	21,600	930	Earth-fill	93	6	Indian Creek
	(Last Chance Creek)	Recreation, stream maintenance	Dixie Refuge	5,740	16,100	800	Earth-fill	81	8	Last Chance Creek

TABLE 25

SUMMARY OF BENEFITS AND COSTS OF INITIAL UNITS
OF UPPER FEATHER RIVER BASIN DEVELOPMENT

Item	Average annual benefits			Capital cost	Annual costs			Benefit:Cost of new		
	Irrigation	Flood control	Recreation		Reimbursement	Nonreimbursable	Total	fit: irrigation	Cost: water, per acre-foot	Ratio
Frenchman Project	\$108,000	\$3,000	\$50,000	\$161,000	\$1,695,000	\$30,000	\$59,000	\$89,000	1.8:1	\$2.50
Grizzly Valley Project	134,000		59,000	193,000	1,900,000	59,000	48,000	107,000	1.8:1	4.00
Indian Creek Recreation Project										
Abbey Bridge			190,000	190,000	801,000		48,000	48,000		4:1
Antelope Valley			138,000	138,000	707,000		47,000	47,000		3:1
Dixie Refuge			284,000	284,000	819,000		48,000	48,000		5.9:1
Subtotals			\$612,000	\$612,000	\$2,327,000		\$143,000	\$143,000	4.3:1	
TOTALS	\$242,000	\$3,000	\$721,000	\$966,000	\$5,922,000		\$250,000	\$339,000	2.9:1	

4. It is indicated that the Alternative Grizzly Valley Recreation Project would have a higher benefit-cost ratio than the Grizzly Valley Project. However, the Grizzly Valley Project would provide needed irrigation water for Sierra Valley, constituting, under state law, a higher use of the water than would occur under the alternative recreation project. For this reason, it was assumed that further consideration of the alternative project would be contingent upon nonacceptance of the Grizzly Valley Project by water users in Sierra Valley.

5. The Frenchman and Grizzly Valley Projects would develop supplemental water supplies for irrigation, which would bring economic gain to local ranchers and provide a stimulus to the general economy of the Upper Feather River Basin. The income to be derived from use of the new irrigation water would be sufficient to repay the costs as allocated to irrigation for purposes of this report, and provide a margin of incentive to local users. However, the price actually to be charged for irrigation water from the projects cannot be definitely determined until policy is established by the Legislature as to the scope of the total project for which repayment allocation is to be made and as to definition of the repayment allocation procedure.

6. Based on the assumptions and conditions cited, the Frenchman Project, the Grizzly Valley Project or the Alternative Grizzly Valley Recreation Project, and the Indian Creek Recreation Project are financially feasible.

7. Water right applications are on file with the State Water Rights Board for storage and use of the waters of Big Grizzly and Little Last Chance Creeks, that conflict with and are prior in time to the filings by the State for the Grizzly Valley Project, the Alternative Grizzly Valley Recreation Project, and the Frenchman Project.

8. Although the Legislative Counsel has interpreted the 1956 statute authorizing the Feather River Project as including the Upper Feather River Basin Development, a clarification of legislative intent in this respect would be desirable. The cited opinion of the Legislative Counsel is included as Appendix C to this report.

9. The Frenchman Project, the Grizzly Valley Project or the Alternative Grizzly Valley Recreation Project, and the Indian Creek Recreation Project would have negligible effects on the control of floods in the Feather River at Oroville. They would reduce by less than 1 per cent the water available from Oroville Reservoir during the critical dry period. This reduction in water supply would cause a loss at Oroville of about 3,000 kilowatts in primary power generation capacity, and an annual reduction in the amount of electrical energy that could be generated of about 8,500,000 kilowatt-hours. The effect on secondary power generation would be negligible. It is indicated that with full water resources development of the Upper Feather River Basin, these minor negative effects on water supply and power production at Oroville Reservoir would be reversed, and that operations at Oroville would be enhanced.

Recommendations

In connection with the initial units of the Upper Feather River Basin Development, and in full cognizance of the foregoing assumptions and conclusions, it is recommended:

1. That the Legislature clarify its intent as to authorization of the Frenchman and Grizzly Valley Projects and the Indian Creek Recreation Project, as set forth in this report, as features of the Feather River Project.

2. That the Legislature make an appropriation of \$1,300,000 for the following purposes in connection with the Frenchman and Grizzly Valley Projects and the Indian Creek Recreation Project:

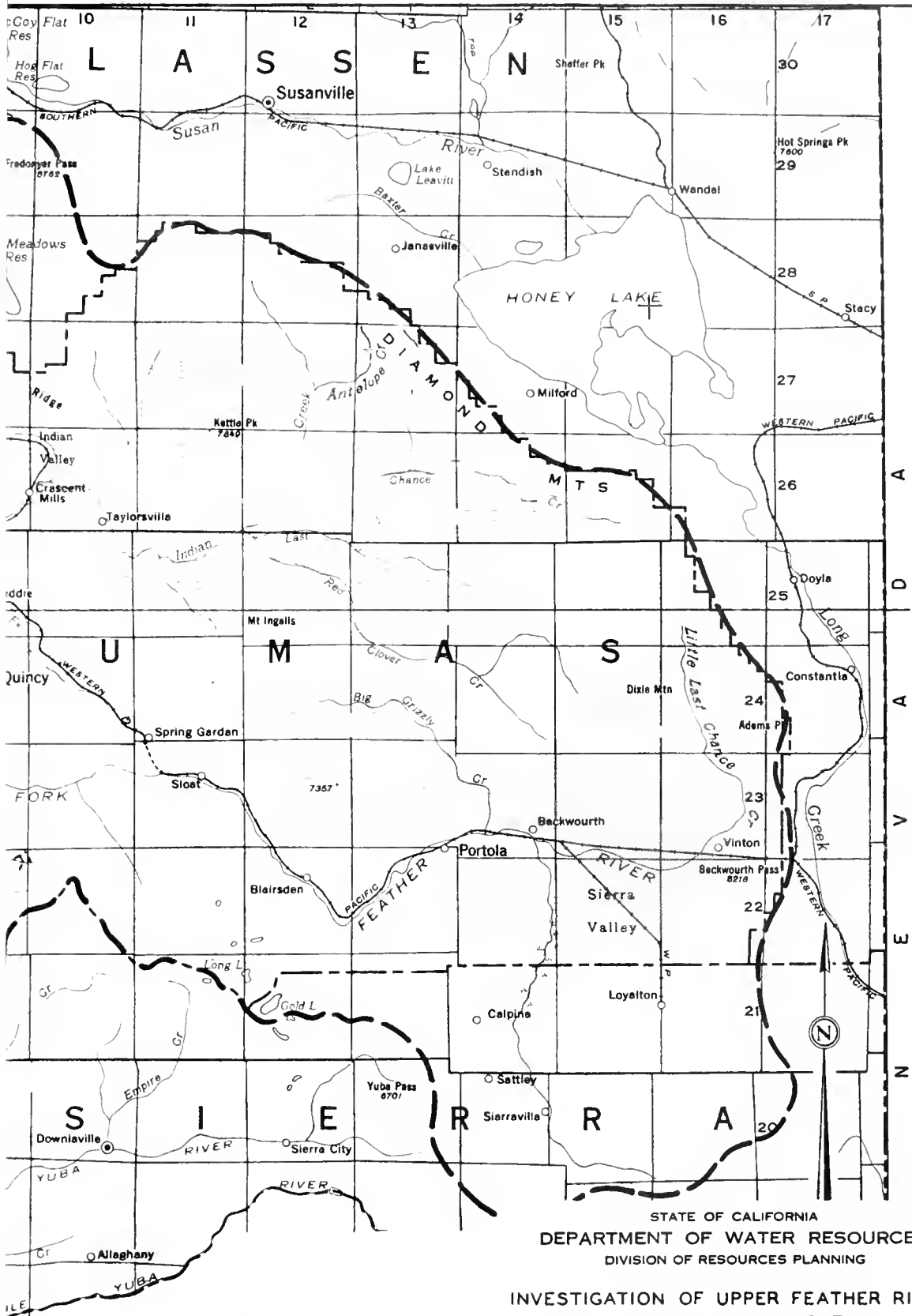
a. Complete the acquisition of lands, easements, and rights of way	\$ 717,000
b. Prepare plans and specifications	350,000
c. Relocate public utilities	<u>233,000</u>
TOTAL	\$1,300,000

3. That negotiations be initiated to determine willingness of prospective water users in Sierra Valley to pay for irrigation water developed by the Frenchman and Grizzly Valley Projects; and that expenditure of funds from the foregoing appropriation for preparation of plans and specifications and relocation of public utilities in connection with these two projects be contingent upon the provision of reasonable assurance by prospective water users in Sierra Valley that they will assume the obligation for repayment of such costs of these projects as may be allocated to irrigation, when policy relating to cost allocation procedure and to scope of the total project for which repayment allocation should be made has been established by the Legislature.

4. That funds be appropriated for construction of the Frenchman and Grizzly Valley Projects and the Indian Creek Recreation Project when necessary water right permits in connection with these projects have been obtained, and when reasonable assurances of repayment of costs allocated to irrigation purposes have been provided by the prospective water users.

5. That the Federal Power Commission be notified of legislative action in connection with the Frenchman and Grizzly Valley Projects and the Indian Creek Recreation Project.

6. That the Legislature establish definite policies for financing and constructing needed local water development projects such as those reported on herein, in which there is determined to be a substantial amount of State interest.



LEGEND

- BOUNDARY OF UPPER FEATHER RIVER SERVICE AREA
- - - PROPOSED PROJECTS

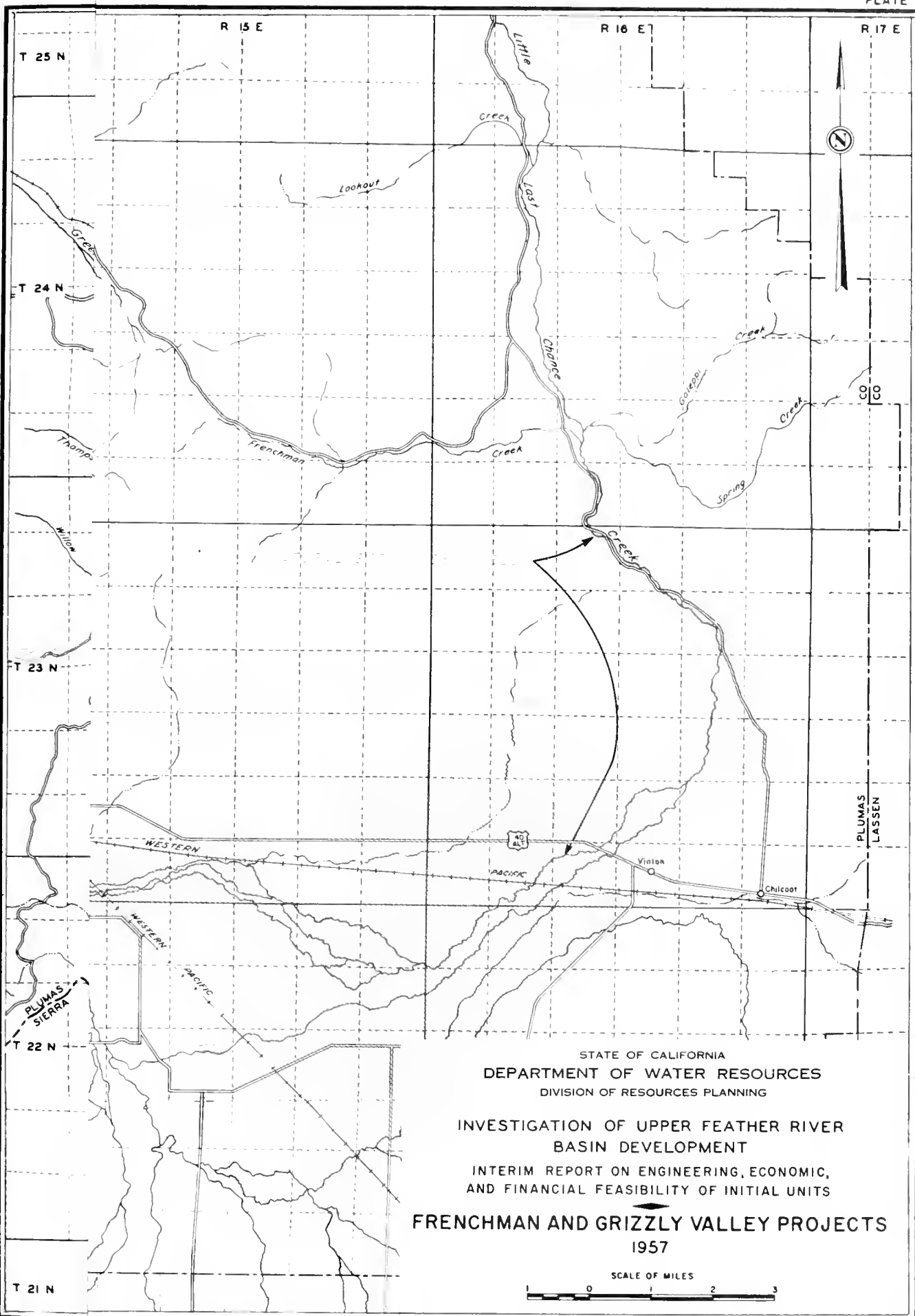
INVESTIGATION OF UPPER FEATHER RIVER
BASIN DEVELOPMENT

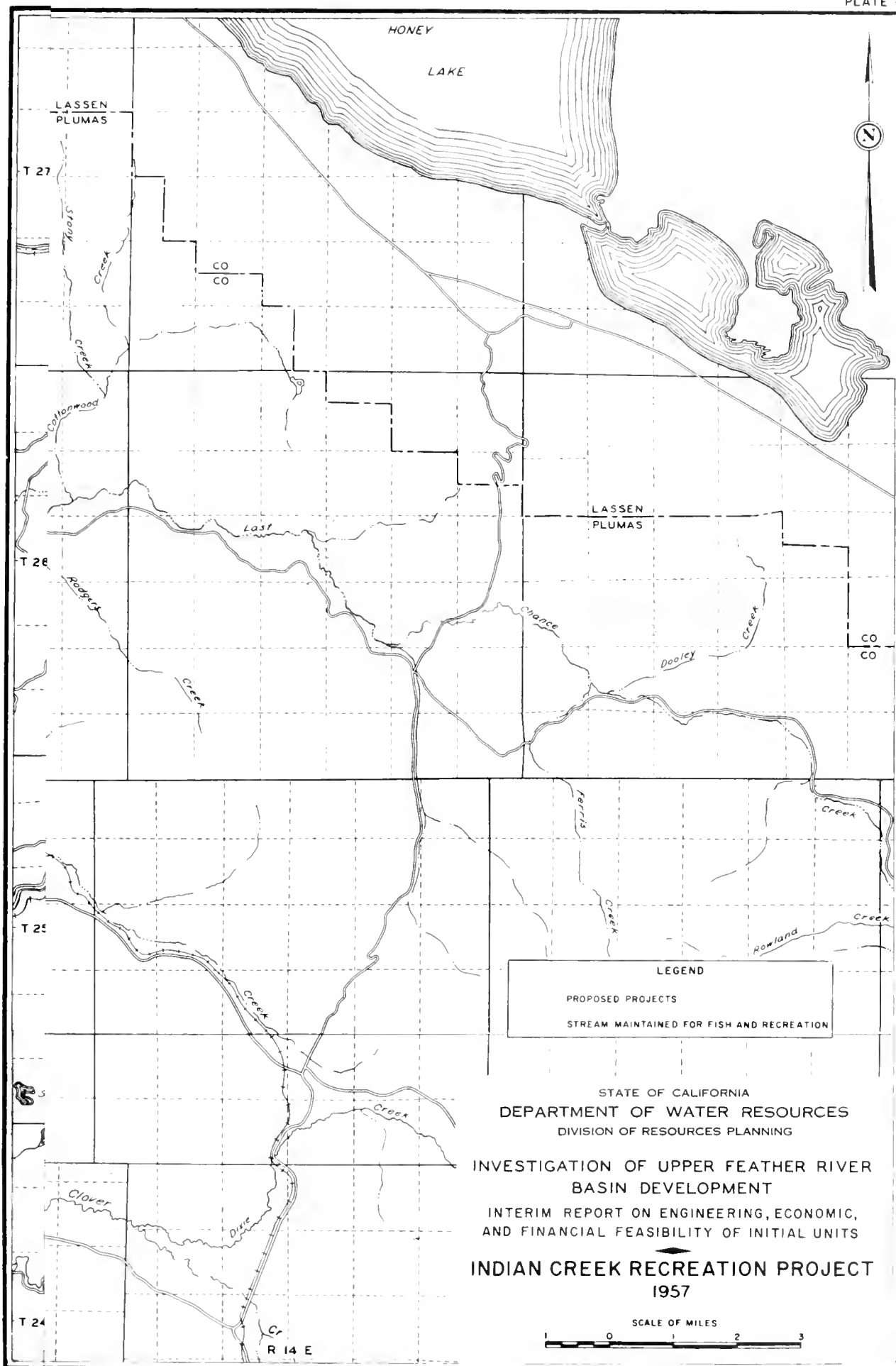
INTERIM REPORT ON ENGINEERING, ECONOMIC,
AND FINANCIAL FEASIBILITY OF INITIAL UNITS

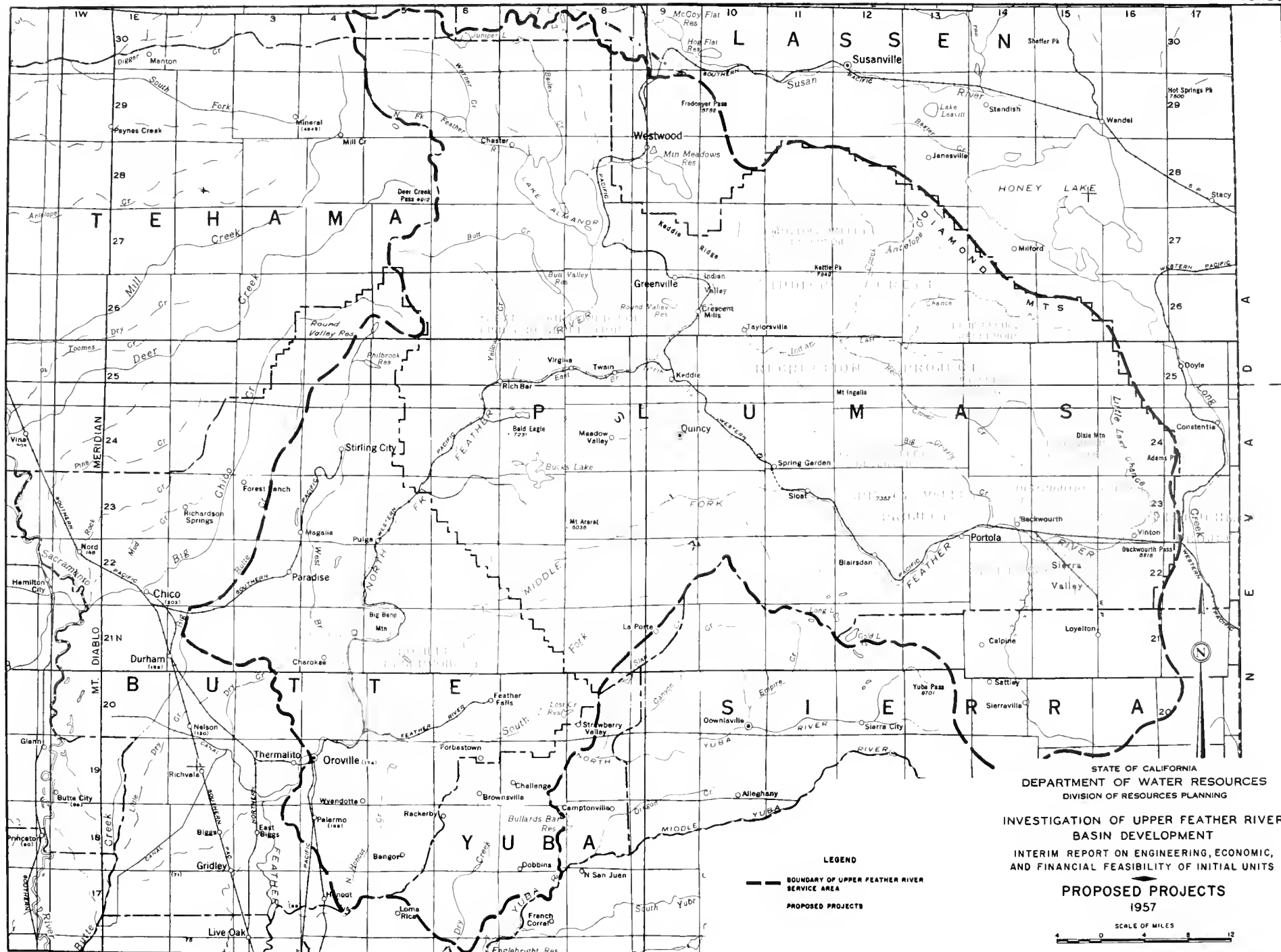
PROPOSED PROJECTS
1957

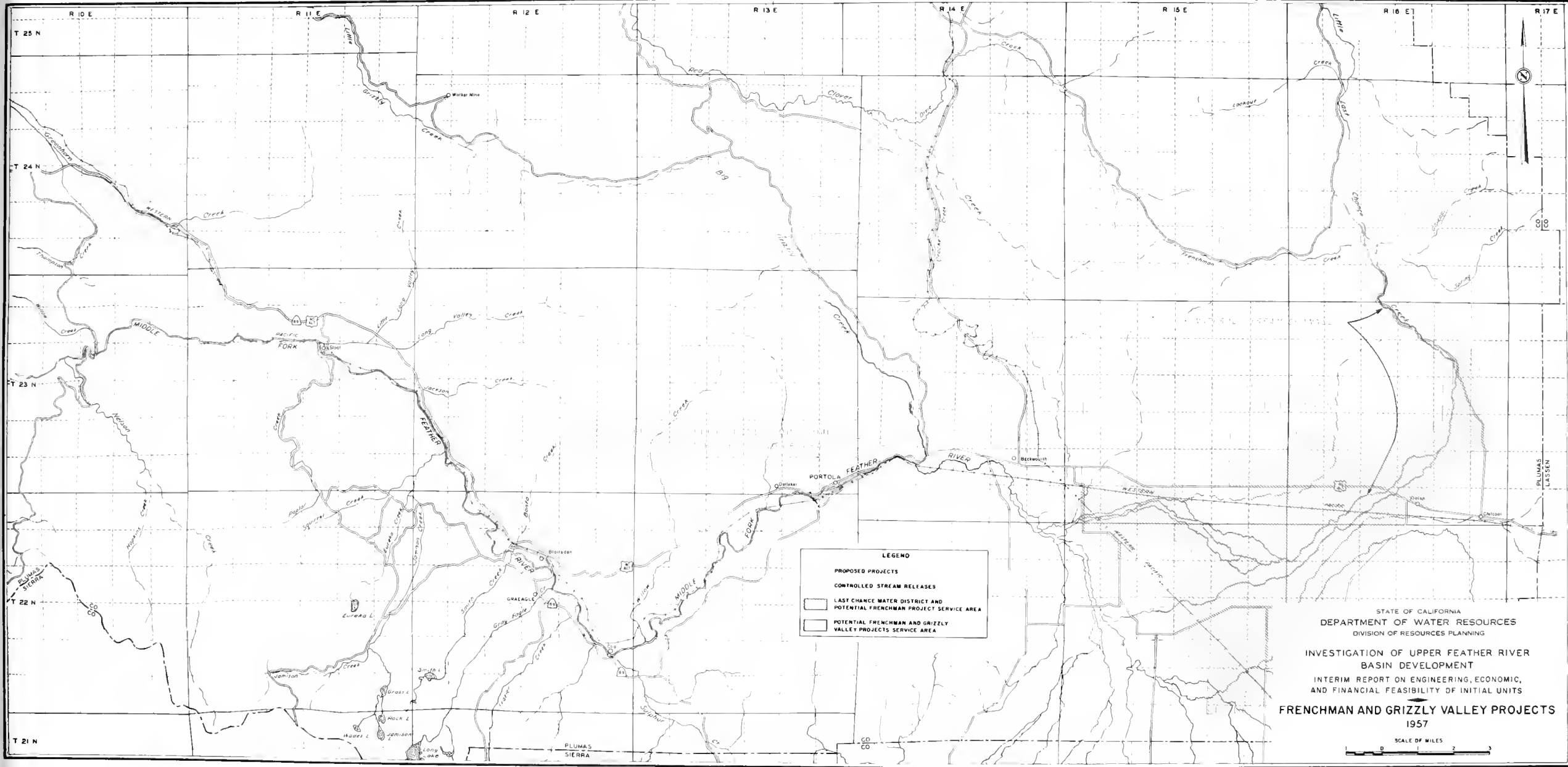
SCALE OF MILES

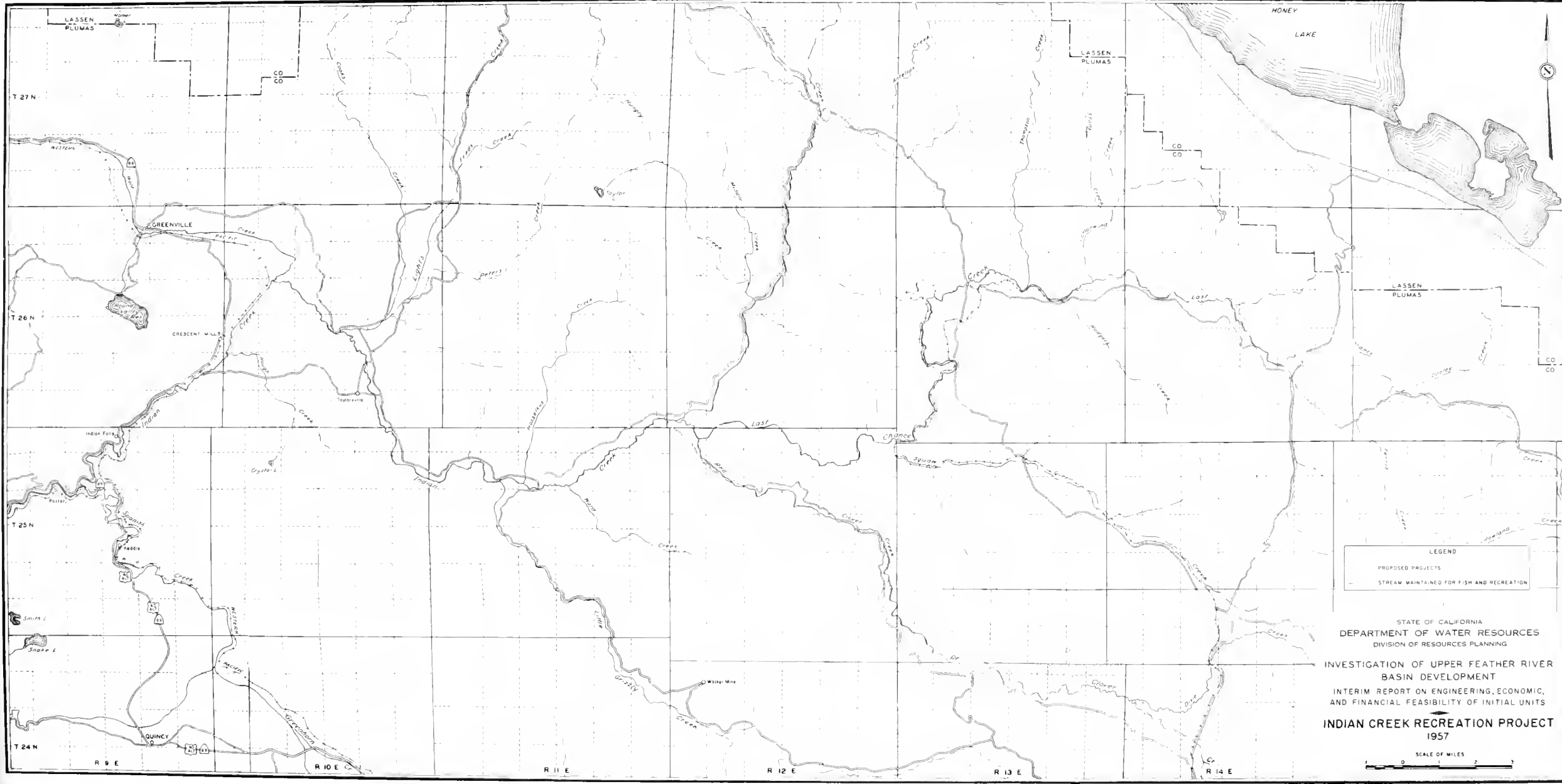












LEGEND
 - - - - - PROPOSED PROJECTS
 ——— STREAM MAINTAINED FOR FISH AND RECREATION

STATE OF CALIFORNIA
 DEPARTMENT OF WATER RESOURCES
 DIVISION OF RESOURCES PLANNING
 INVESTIGATION OF UPPER FEATHER RIVER
 BASIN DEVELOPMENT
 INTERIM REPORT ON ENGINEERING, ECONOMIC,
 AND FINANCIAL FEASIBILITY OF INITIAL UNITS
 INDIAN CREEK RECREATION PROJECT
 1957

SCALE OF MILES
 0 1 2

APPENDIX A

EVALUATION OF RECREATION BENEFIT FROM
FIVE PROPOSED RESERVOIRS IN
UPPER FEATHER RIVER BASIN

Prepared by
Harold F. Wise & Associates, Consultants

EVALUATION OF RECREATION BENEFIT FROM FIVE PROPOSED
RESERVOIRS IN UPPER FEATHER RIVER BASIN

prepared by

Harold F. Wise & Associates, Consultants
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707 Forum Building
Sacramento 14, California

for the

State of California
Department of Water Resources

January 18, 1957

HAROLD F. WISE & ASSOCIATES

PLANNING AND URBAN ECONOMICS

707 Forum Building, Sacramento 14, California

January 18, 1957

telephone Gilbert 2-4877

Mr. Harvey O. Banks, Director
Department of Water Resources
State of California
1120 N Street
Sacramento 14, California

Dear Mr. Banks:

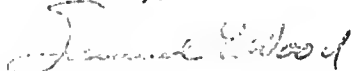
We submit to you our report on recreational development and use of five proposed reservoir site areas in the Upper Feather River Basin. These are the projects known as Antelope Valley, Dixie Refuge, Abbey Bridge, Grizzly Valley, and Frenchman.

The analysis presented in this report indicates that if the reservoirs are built, recreational use of the reservoirs will, by itself, yield benefits which substantially outweigh the costs of the public facilities needed to make such use possible. This favorable ratio of recreational benefits is based on consideration of the reservoir areas apart from their uses for flood control, irrigation, and fish and wild life preservation, and does not reflect capital costs of the dams. It is assumed that feasibility will be determined by comparison of the total benefits for all purposes with the total costs of development, of which recreation is one part.

We appreciate the cooperation of your staff in providing engineering, operational, and development data on the reservoir projects which were essential for an analysis of recreation benefit.

We trust this analysis will assist in determinations as to the feasibility of the projects.

Sincerely,



SAMUEL E. WOOD
Resident Partner.

Enclosure.

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II Present recreational use of five proposed reservoir areas	4
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PLATES

Plate
A Graph: Recreation Visitor-Days and California Population, 1941 - 2050
B Grizzly Valley Reservoir Illustrative Site Development Plan
C Antelope Valley Reservoir Illustrative Site Development Plan
D Abbey Bridge (formerly Red Clover) Reservoir Illustrative Site Development Plan
E Dixie Refuge Reservoir Illustrative Site Development Plan
F Frenchman Reservoir Illustrative Site Development Plan

EVALUATION OF RECREATION BENEFIT FROM FIVE PROPOSED RESERVOIRS IN UPPER FEATHER RIVER BASIN

Introduction

Five of the proposed water resource developments in the Upper Feather River Basin have been evaluated in terms of their potential contribution to the recreational assets of the area. These developments are the proposed reservoirs known as Grizzly Valley, Antelope Valley, Abbey Bridge, Dixie Refuge and Frenchman.

Evaluation of the proposed reservoirs as recreation assets has been made on the assumption that they will form part of a general development of the recreation resources of the Upper Feather River Basin, one of the most attractive and accessible recreation areas of the State.

One of the resources which has been appraised during this survey is Genesee Valley, which we believe has a high rating for development as a recreation area. Genesee Valley, on Indian Creek, forms a natural gateway to the Antelope Valley, Dixie Refuge, and Red Clover reservoir areas, and the Diamond Mountains primitive area to the east.

With construction of a small reservoir at its east end, Genesee Valley would attract motels, restaurants, dude ranches and similar facilities and these would enable a large number of people to visit the reservoir areas of the Upper Feather River Basin than would otherwise occur. Successful recreational development of the Upper

Feather River Basin will, in our opinion, depend to a large extent on proper development of Genesee Valley as a focal point and means of entry into the higher country beyond.

Development of the recreation resources of the Upper Feather River Basin is considered as an important part of the State's natural resources for meeting the recreation needs of an expanding population. In mid-1956, California had an estimated population of 13,600,000. In the next 100 years or less, the State's population is expected to grow to approximately 45,000,000. In addition, the State must continue to prepare for a large influx of out-of-state visitors. In 1953, for example, there was one out-of-state tourist for every three California residents.^{1/}

Demand for outdoor recreation facilities will be further intensified by the higher proportion of state population living in urban areas in the future. Higher incomes, more leisure, and improved transportation will increase the mobility of the population and its ability to enjoy the recreation resources of areas like the Upper Feather River Basin.

In this context, it is assumed that public policy will require maximum development of the State's recreation resources, and that the Upper Feather River Basin will play an important part in satisfying this demand.

^{1/} Kenneth Decker, The Tourist Trade in California, Bureau of Public Administration, University of California 1955.

I. Trends in recreational use of the Basin

Presently developed recreation facilities in the Basin include the areas around Lake Almanor, Bucks Lake, and the Lakes Basin, and along the forks of the Feather River. Recreation use of the Upper Feather River Basin area is steadily increasing. For example, records of the United States Forest Service show that visitor-days use of camp grounds in Plumas National Forest increased from 76,650 in 1950 to 269,863 in 1955. The Upper Feather River Basin now accounts for about five percent of total visitor-days use of all national forests in the State. By the year 2050, it is reasonable to expect that the Basin will account for seven to eight percent of visitor-days use of national forests in the State, and the proportion may well be higher because of the Basin's unusual attractions.

The anticipated trend of recreational use of the Upper Feather River Basin is shown on the accompanying graph entitled "Recreation Visitor Days and California Population, 1941 - 2050" (Plate A). The graph records the projected trend of visitor-days use of all national forests in California, and of Plumas National Forest. Approximately 70 percent of the land area of the Upper Feather River Basin is within national forest boundaries, chiefly Plumas National Forest, but also including parts of Lassen and Tahoe National Forests. Forest Service records provide practically the only available historical record on which to base a projection of the trend of recreation use in the area.

Recreation use of California's national forests, measured in visitor-days, has more than doubled since 1941 when reliable records began to be kept. Thus in 1941,

use was estimated at 14,475,541 visitor-days, equivalent to two days per state resident per year. In 1956, use was estimated at 31,073,622 visitor-days, equivalent to 2.4 days per state resident per year. Projecting to the year 2050, as shown on the graph, it is anticipated that visitor-days of use of national forests will approximate 10 days per resident per year.

Use of Plumas National Forest recreation areas has increased three and one-half times since 1946. Distinction is made in the graph between total visitor-days, and visitor-days accounted for by persons "driving through" the national forests to enjoy the scenery and environment. Persons "driving through" are presently not counted by the Forest Service as "users" of public recreation facilities. As facilities are developed, however, there is every reason to believe that an increasing proportion of persons driving through will become users.

Furthermore, persons who now drive through may in many, if not most, cases patronize private facilities adjacent to the national forests, such as hotels, motels, restaurants and stores. This constitutes an important part of the total demand for recreation facilities.

Present recreational use of five reservoir areas

Present recreational use of the five reservoir areas is nominal and almost entirely limited to hunting and fishing. Estimates of the State Department of Fish and Game indicate the following use of the reservoir areas, in visitor-days per year, as of 1956:

<u>Reservoir</u>	<u>Hunting</u>	<u>Fishing</u>	<u>Total</u>
Antelope Valley	500	500	1,000
Dixie Refuge	500	100	600
Abbey Bridge	500	100	600
Grizzly Valley	700	200	900
Frenchman	<u>1,000</u>	<u>100</u>	<u>1,100</u>
	3,200	1,000	4,200

If the proposed dams were not constructed, the use of the area by hunters and fishermen could nevertheless be expected to increase year by year. There is also the likelihood that camp grounds and resorts would be developed to accommodate these visitors and other persons seeking to enjoy the scenery and climate. With the large bodies of water the reservoirs would create, however, the attractions of the sites would be multiplied many times.

The purpose of this study is to estimate how much the recreational use -- and the corresponding recreational benefit in dollar terms -- would be increased by construction of the proposed reservoirs.

III. Projected recreational use of five reservoir areas

Evaluation of potential recreational use of the five proposed reservoirs is based on study of the terrain around each site; classification of areas around the site according to the use for which they appear best fitted, i.e., camp and picnic areas, summer residences, resorts, or organizational camp sites, and an illustrative site development plan for each reservoir showing its capacity in units and visitors. (Plates B - F).

The evaluation takes into account the operational characteristics of the proposed dams, and the probable effect of a fluctuating lake level and shoreline on

recreation use. However, past experience suggests that even unfavorable operational characteristics will not deter recreational use of a reservoir area.

Development of the reservoir areas will depend to considerable extent on improvement and extension of the present road system which connects them with major highways, with each other, and with other recreation areas in the Upper Feather River Basin, including Genesee Valley.

Recreation use of the reservoir sites has been projected over a 90-year period, starting in approximately 1960 (when it is assumed that necessary roads and public camp and picnic facilities will be installed and reservoirs will be at operational levels) and extending to year 2050. It is assumed that use (measured in visitor-days) will increase at a fairly uniform rate over the whole 90-year period, the rate of increase being somewhat greater in the first half of the period and flattening out somewhat in the second half. Under these assumptions probable maximum use would not be reached until the year 2050 and would approximate the visitor-day estimates shown in Table I. (Curves showing the anticipated rates of recreation development at each reservoir site will be shown in a later report on the recreation potential of the Upper Feather River Basin).

TABLE I
Probable Annual Recreational Use of Reservoir Areas -- 2050^{1/}

	Annual Visitor Days	
	<u>Without Reservoir</u>	<u>With Reservoir</u>
Grizzly Valley	71,525	297,470
Antelope Valley	45,070	194,670
Abbey Bridge	40,340	181,755
Dixie Refuge	30,790	134,725
Frenchman	34,515	230,905
Totals	<u>222,240</u>	<u>1,039,525</u>

^{1/} Probable use estimated at half of theoretical capacity use with full development of sites and access roads.

Computation of recreation benefit from the proposed reservoir projects has been based on use during the first 50 years of the life of the projects, or approximately 1960 to 2010. Cumulative use during this 50-year "pay-out" period has been estimated, both with and without the proposed reservoirs, and is shown in Table II. The difference between anticipated use with reservoirs and anticipated use without reservoirs is the basis for measuring the net recreation benefit from construction of the reservoirs.

As indicated in Table II, cumulative total use of all reservoir sites by year 2010, at the end of the 50-year pay-out period, would approximate 13,906,000 visitor-days at the anticipated rates of development, if the reservoirs are constructed -- compared with 1,264,000 visitor-days if no reservoirs are constructed. Thus the estimated net increase in total use due to reservoir construction approximates 12,642,000 visitor-days over the 50-year period.

For project justification and cost analysis purposes, only the use of facilities constructed with public funds is taken into account. The comparison between use with reservoirs and use without reservoirs indicates a net increase of 8,272,000 visitor-days over the 50-year period if all reservoirs are built.

TABLE II

CUMULATIVE VISITOR-DAYS USE OF RESERVOIR SITES DURING
"FIFTY-YEAR INVESTIGATIONAL PERIOD, 1961 - 2010

	Cumulative Visitor Days		Net Increase
	<u>No Reservoir</u>	<u>Reservoir</u>	<u>in Visitor Days</u>
<u>Total Recreational Use</u>			
Grizzly Valley	338,100	3,457,650	3,119,550
Antelope Valley	247,200	2,951,650	2,704,450
Abbey Bridge	241,750	2,383,250	2,141,500
Dixie Refuge	204,650	2,349,450	2,144,800
Frenchman	<u>232,750</u>	<u>2,764,550</u>	<u>2,531,800</u>
Totals	1,264,450	13,906,550	12,642,100
<u>Use of Public Facilities Only</u>			
Grizzly Valley	237,550	2,208,150	1,970,600
Antelope Valley	191,500	1,882,350	1,690,850
Abbey Bridge	163,850	1,818,650	1,654,800
Dixie Refuge	162,600	1,476,050	1,313,450
Frenchman	<u>177,950</u>	<u>1,819,850</u>	<u>1,641,900</u>
Totals	933,450	9,205,050	8,271,600

IV. Comparison of benefits and costs

Recreational benefit from construction of the five reservoirs has been computed by applying a figure of \$2.00 per visitor-day to the net increase in use due to reservoir construction and public facilities, access roads, etc. (Derivation of the \$2.00 figure is discussed in the next section).

Recreational benefit, thus computed, has been adjusted to a basis of present worth. To obtain present worth, recreation benefit for each year of use has been discounted at three percent, cumulatively, beginning with year 1961. Thus the present worth of recreation use in year 1961 is computed at 97.1 percent of the estimated recreation benefit for that year. For the year 2010, the present worth factor is 22.8 percent of the estimated recreation benefit.

Recreational costs are construed to be those for the installation of public facilities -- camp and picnic grounds -- and construction of necessary roads to serve these facilities. Costs have been estimated on the basis of unit costs shown in Table III.

Capital costs were computed for each year of use by application of these unit costs to the number of new camp and picnic units and miles of road constructed. Operating, maintenance and replacement costs were computed for each year by applying the unit costs to the net increase in number of units resulting from reservoir construction. All costs were combined for each year and adjusted to a present worth basis.

TABLE III

UNIT COSTS OF PUBLIC FACILITIES

Capital costs of one camping and picnic unit:

Table, fireplace, food locker, and paved parking area for one automobile	\$260
Comfort station (pro-rated at one for each 50 camp and picnic units)	160
Combination shower and comfort station (at one per 50 units)	260
Shop and equipment building (at one per 200 units)	40
Housing for park personnel (at one residence per 200 units)	<u>80</u>
Total capital cost per camping and picnic unit	\$750

Capital costs per mile of road construction:

Specifications:

30 foot right-of-way
 two shoulders, six feet in width, four-inch depth of crushed rock
 two eleven-foot paved lanes, four-inch crusher run base, two-inch
 asphaltic hot plant mix

Total cost per mile	35,000
---------------------	--------

Operating costs for camp and picnic unit, including salaries

Power and salaries per year	64
Maintenance costs of one camping and picnic unit estimated at one and one-half percent of cost of structures per year, with replacement each 25 years:	41
Road maintenance and replacement, including major repair and resurfacing, per mile, per year:	400

Table IV summarizes benefits and costs involved in recreational use of the five reservoir sites over the 50-year "investigational" or pay-out period. Net benefits are computed on two bases:

1. Estimated increase in total use of recreation facilities, both public and private, if reservoirs are built, compared with projected use if reservoirs are not built.
2. Estimated increase in use of public facilities only, if reservoirs are built, compared with projected use if reservoirs are not built. This is the basis used for project justification and cost analysis purposes.

TABLE IV

NET CUMULATIVE TOTAL BENEFITS AND COSTS AT END OF
"FIFTY-YEAR INVESTIGATIONAL PERIOD", 1961 - 2010

	Net benefit for all recre- ational uses	Net benefit for public recreation	Net cost of pub- lic recreational facilities <u>1/</u>
<u>Grizzly Valley</u>			
Cumulative dollar benefit and costs	6,239,100	3,941,200	1,445,175
Adjusted to present worth	2,318,609	1,529,144	623,220
Annual present worth equivalent	90,124	59,437	24,224
<u>Antelope Valley</u>			
Cumulative dollar benefit and costs	5,408,900	3,381,700	1,211,895
Adjusted to present worth	2,158,624	1,368,410	565,814
Annual present worth equivalent	83,905	53,190	21,993
<u>Abbey Bridge</u>			
Cumulative dollar benefit and costs	4,283,000	3,309,600	1,272,150
Adjusted to present worth	1,674,217	1,302,234	566,832
Annual present worth equivalent	65,076	50,617	22,032
<u>Dixie Refuge</u>			
Cumulative dollar benefit and costs	4,289,400	2,626,900	978,490
Adjusted to present worth	1,730,596	1,083,061	469,921
Annual present worth equivalent	67,268	42,098	18,265
<u>Frenchman</u>			
Cumulative dollar benefit and costs	5,063,600	3,283,800	1,229,740
Adjusted to present worth	1,892,385	1,284,357	537,062
Annual present worth equivalent	73,557	49,942	20,875
<u>Totals</u>			
Cumulative dollar benefit and costs	25,284,000	16,543,200	6,146,450
Adjusted to present worth	9,774,431	6,567,706	2,762,849
Annual present worth equivalent	379,930	255,284	106,589

1/ These figures include capital, operating, and maintenance costs for public recreational facilities and the additional roads required to service these facilities. Private expenditures for summer homes, resorts and organizational camps are not included.

V. Measurement of the dollar value of a day's recreation*

A figure of \$2.00 per visitor -day has been selected to represent the average recreational benefit from use of facilities at the proposed reservoir sites. This figure is used with full knowledge of the difficulty of finding an acceptable monetary measure of recreational enjoyment. It is, however, considered to be a conservative measure of recreational value for purposes of benefit-cost analysis of the projects, and is in line with benefit figures currently used by federal agencies.

The figure has been arrived at after extensive review of the literature of recreation benefit analysis, and a series of conferences with representatives of most public and private agencies having a direct interest in the measurement of recreation benefits. Public agencies represented at conferences include the United States Forest Service, Department of Commerce, Corps of Engineers, Bureau of Reclamation, and National Park Service; and the State Division of Beaches and Parks, Department of Fish and Game, Department of Natural Resources, Department of Water Resources, and the University of California School of Forestry.

Private agencies represented at conferences include the State Chamber of Commerce, the California State Automobile Association, Californians, Inc., The Southern Pacific Company, Pacific Greyhound Lines, Western Air Lines, Standard Oil Corporation, resort owners and sportsmen.

*Material in this section is based on a comprehensive study of the problem of measuring recreation benefits made by Professor Andrew Trice of Sacramento State College. His analysis will appear in a later report on recreational resources of the Upper Feather River Basin which is being prepared by Harold F. Wise and Associates.

While the agencies listed above are in no way responsible for selection of the \$2.00 figure, the information and opinions derived from the conferences were helpful in reaching a decision to use this figure.

Most public agencies concerned with the problem of measuring recreation benefit have been reluctant to use a dollar measure because of the subjective nature of the recreational enjoyment and the danger that any acceptable dollar figures will understate the actual value of recreational facilities. They have generally felt that public expenditures for recreation facilities are best justified in terms of accepted public policy which includes governmental responsibility to promote health and welfare.

Where recreational benefit is a relatively small proportion of the total benefits derived from a public project, as in the case of a multi-purpose flood control, power and irrigation facility, the lack of a monetary measure is of small concern in justifying the project. However, where recreation is expected to be a substantial or major product of project expenditures, it may be desirable and necessary to promote the concept that a monetary value may be assigned to it. Where a dollar value is assigned, care should be taken not to depreciate the importance of recreation from the point of view of public policy.

Major General E. C. Itschner, Chief of Engineers, U. S. Army, has stated that even in the case of projects built primarily for flood control and navigation, the recreational benefits are becoming increasingly important and recognized. In his words, "these benefits should be taken into account in project planning". General

Itschner points out that "though the question of evaluating recreation benefits will require much more study and experience, it would seem that a satisfactory method could be based upon the concept of the benefit from a visitor day of use". (Remarks before Arkansas Basin Development Association, October 29, 1956).

One approach to measuring recreation benefit is through study of what people spend per day while engaged exclusively in recreation activity. Analysis of 37 case studies of tourist and other recreation expenditure indicates a range of \$4.00 to \$18.00 per visitor-day, with most expenditures in the range of \$5.00 to \$11.00. The median expenditures shown by the 37 studies is \$8.00 per visitor-day. These studies range over a number of states and cover the years 1948 - 1955.

Sample studies in Plumas County in 1956 indicate an average of \$7.64 spent per visitor-day by fishermen, and \$6.54 by other recreationists.

A 1956 survey by the American Automobile Association on the travel habits of its members revealed, on the basis of more than 13,000 returns, that the average daily expenditure per person for trips of less than one week was \$7.58. For trips of one week, the average was \$10.32; and for trips of two weeks it was \$9.31.

Expenditure figures measure what recreationists spend on goods and services bought in the economic market place. They are a useful measure of the impact of recreation activity on a local business community. However, much of the expenditure would have occurred if the people had stayed home, and is therefore simply a transfer of business from one area to another.

Most important, expenditures do not represent the value which people obtain

from recreation, and for which there is no charge in the economic market place.

At best, then, a measure of recreation benefit is a value judgment and should be accompanied by explanation of the non-monetary benefits and values which individuals, society and the state derive from recreation projects.

The \$2.00 figure used in this study is intended to represent the intangible value, over and above actual expenditures on the trip, which the average visitor obtains from his day of recreation in the Upper Feather River Basin. It may be reasoned that if the food, lodging, gasoline, boat rental and other goods and services which he buys are worth the expenditure of \$8.00 per day to him, then the intangibles of scenery, climate, spiritual uplift, and release from the pressures of the daily work routine in the cities "down below" are worth at least an additional \$2.00, even though there is no one to collect it from him.

The \$2.00 figure has been selected on no single statistical basis, but after consideration of the whole range of current proposals for solution of the problem of measuring recreation benefits. There is, however, considerable support for the figure in the results of an analysis of data from a 1956 survey by the State Department of Fish and Game, showing numbers of visitors to the Upper Feather River Basin, their average lengths of stay, and distances travelled to the Basin. These data make it possible to compute the travel cost per visitor-day for persons visiting the area. The upper range of travel costs per visitor-day may be taken to represent what vacationers considered the trip to be worth; the average cost indicates what most people had to pay. The difference between the upper range of costs and the average cost, which approximated \$2.00 per visitor-day, may be described as a partial measure of the net enjoyment attributable to the recreation resources of the area.

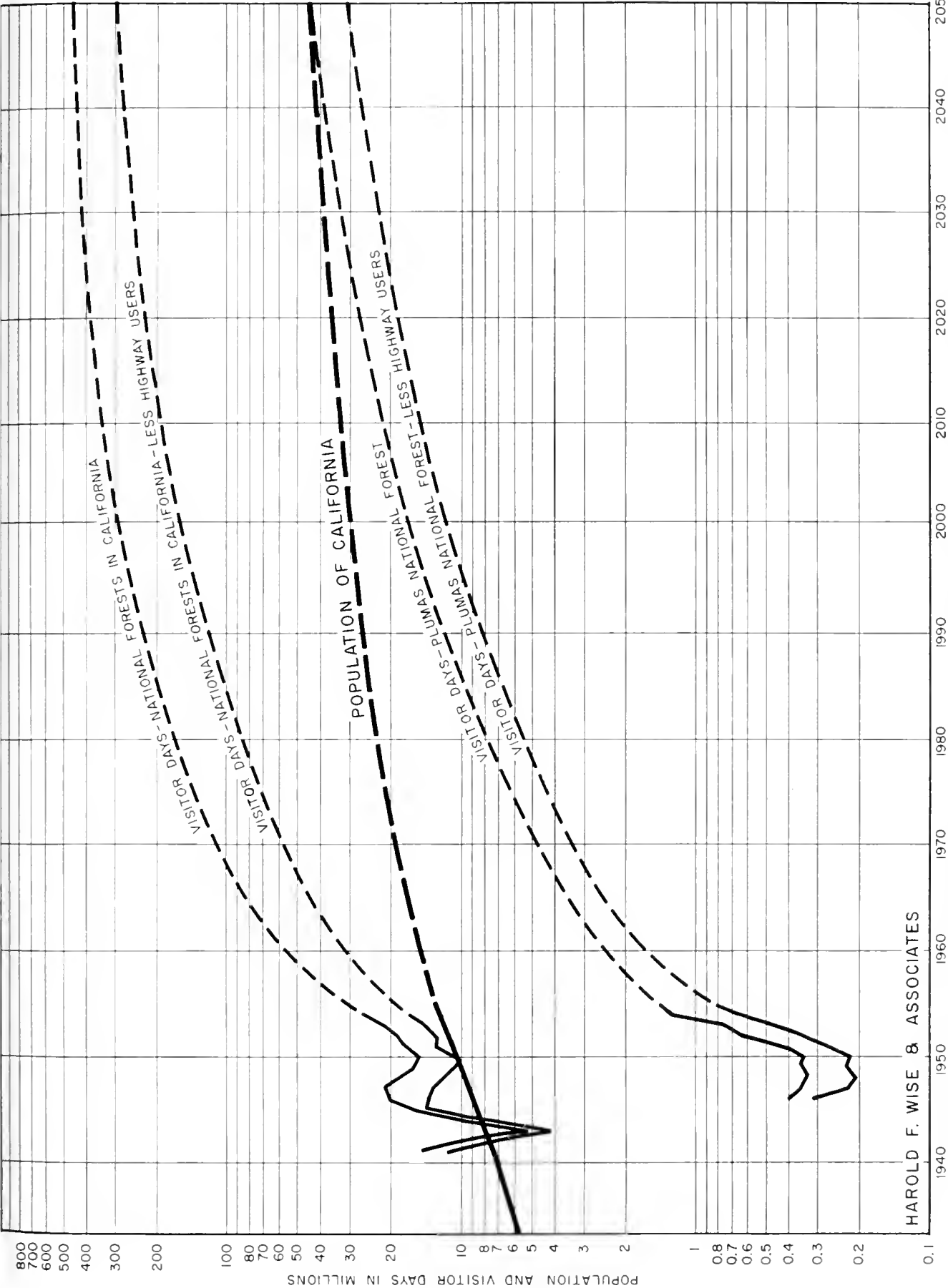
Over the life of the proposed projects, the value of the recreation benefit should increase substantially. Thus by the year 2010 the comparable benefit is likely to be closer to \$3.00 per visitor-day than to \$2.00.

HAROLD F. WISE & ASSOCIATES

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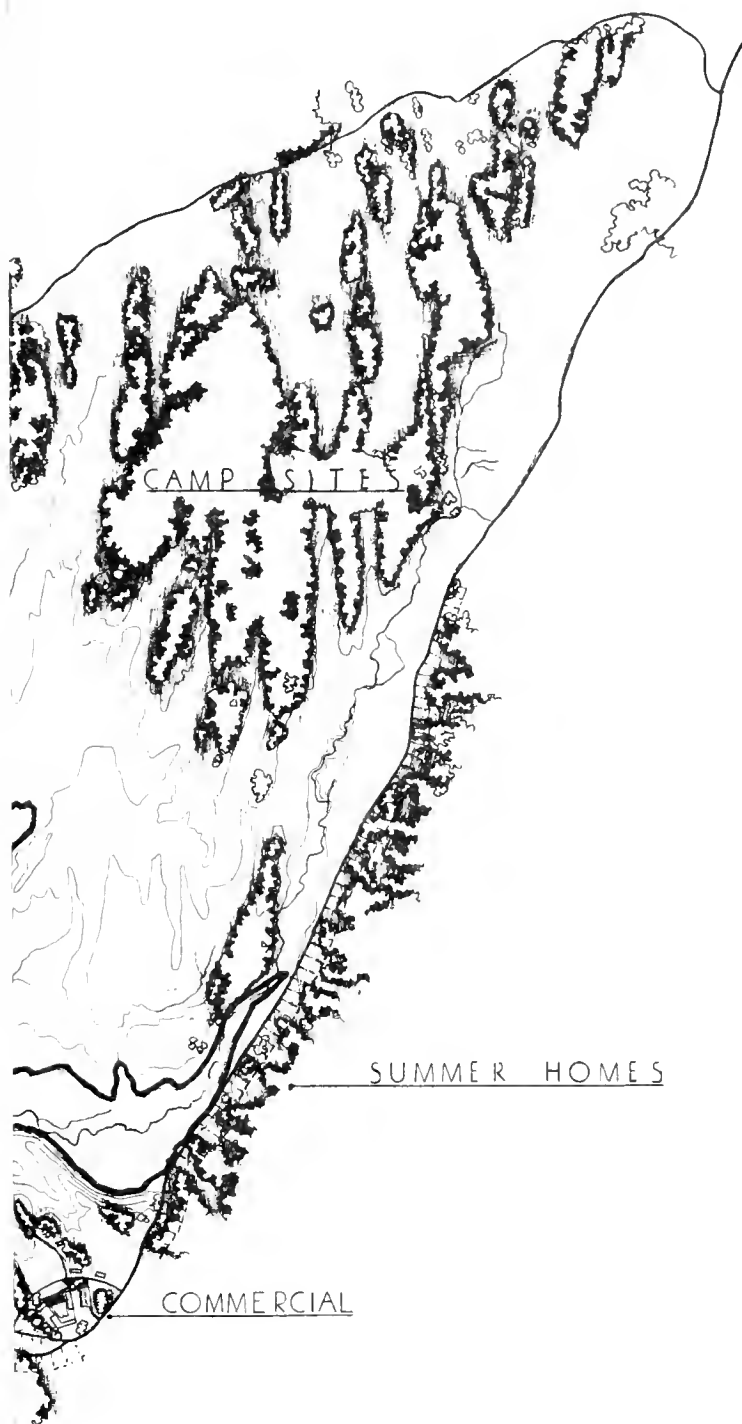
Andrew Trice,
consulting economist



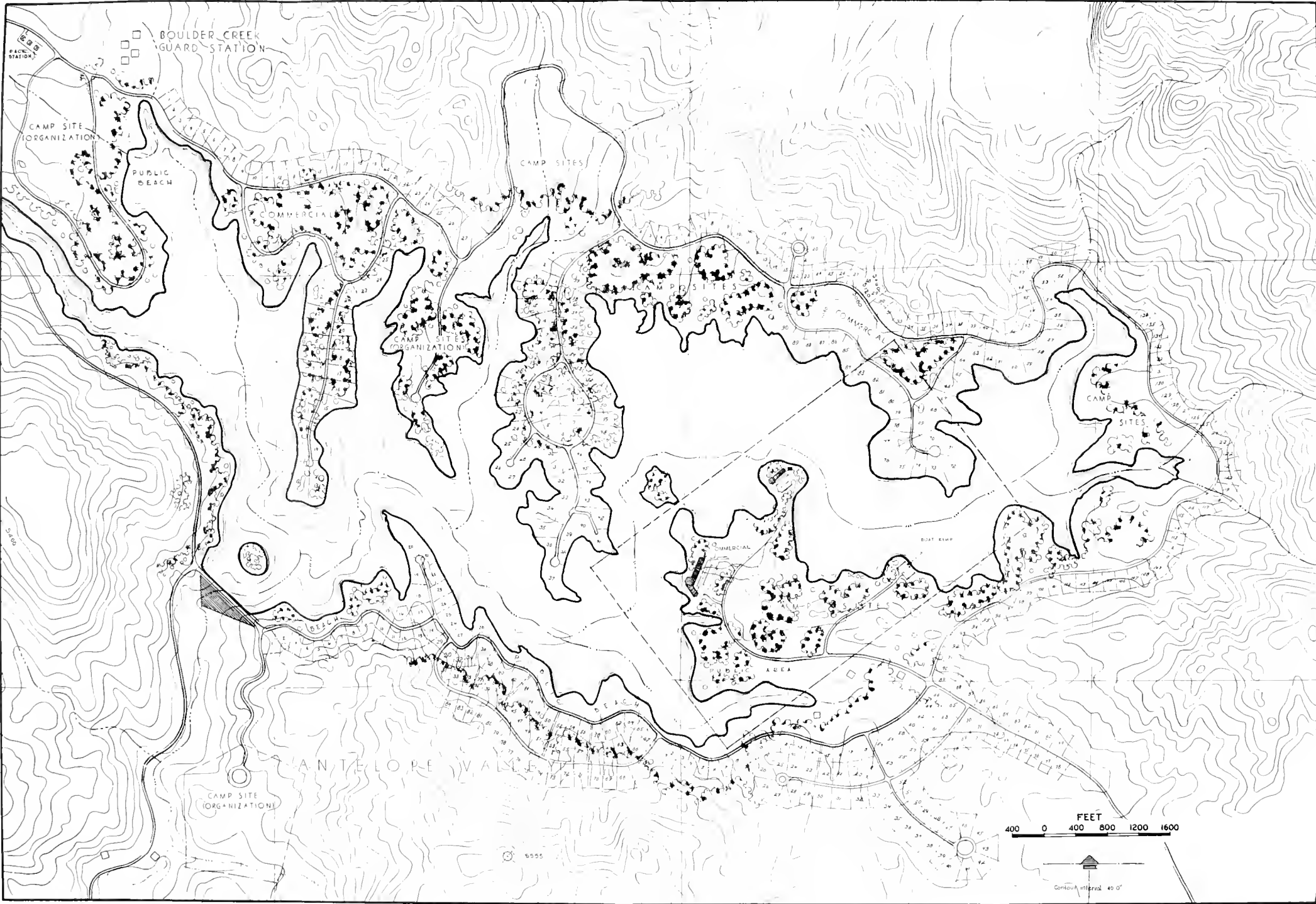
HAROLD F. WISE & ASSOCIATES
RECREATION VISITOR DAYS AND CALIFORNIA POPULATION 1941 - 2050



HAROLD F. WISE AND ASSOCIATES
ILLUSTRATIVE RECREATIONAL SITE PLAN FOR GRIZZLY VALLEY RESERVOIR

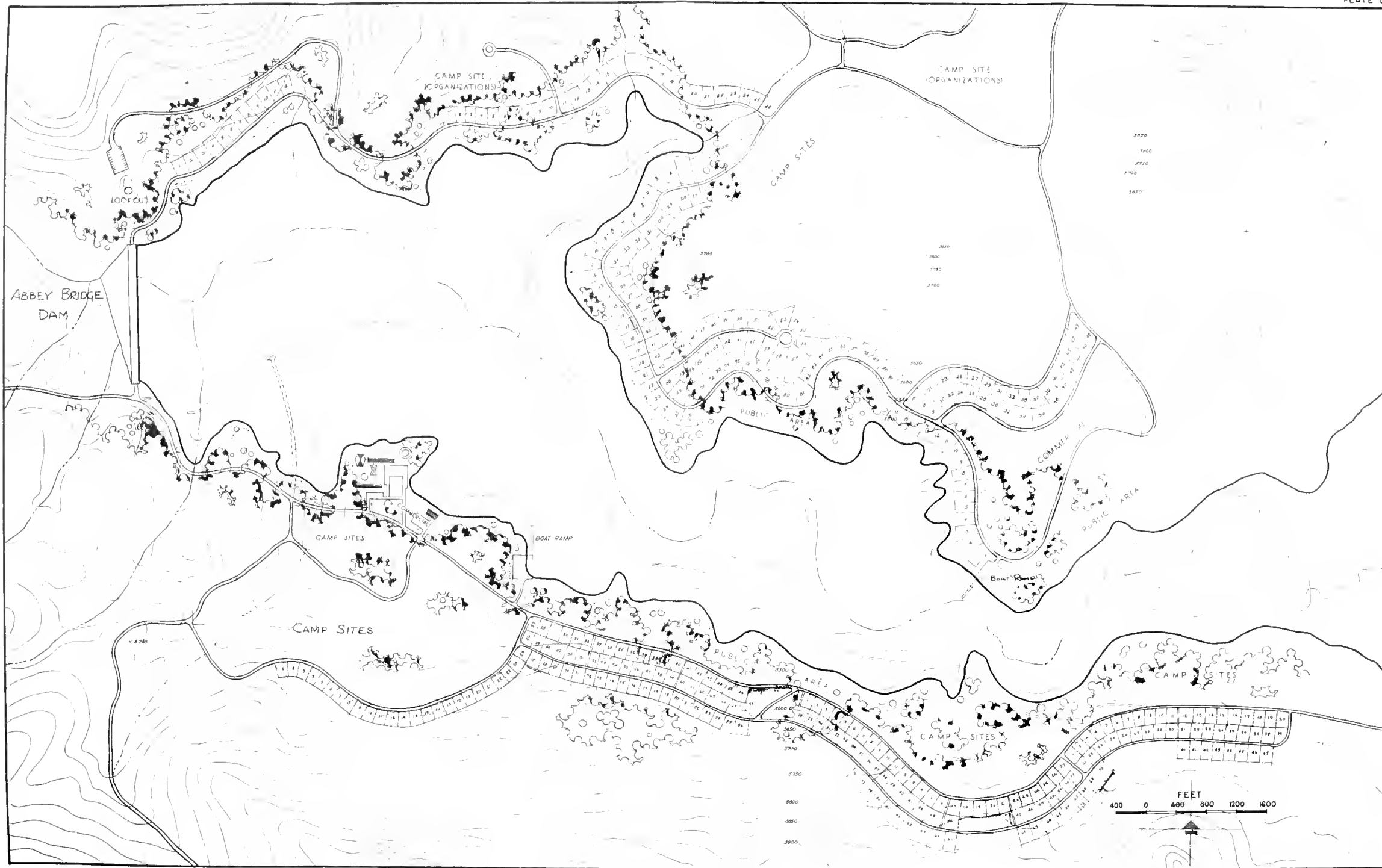


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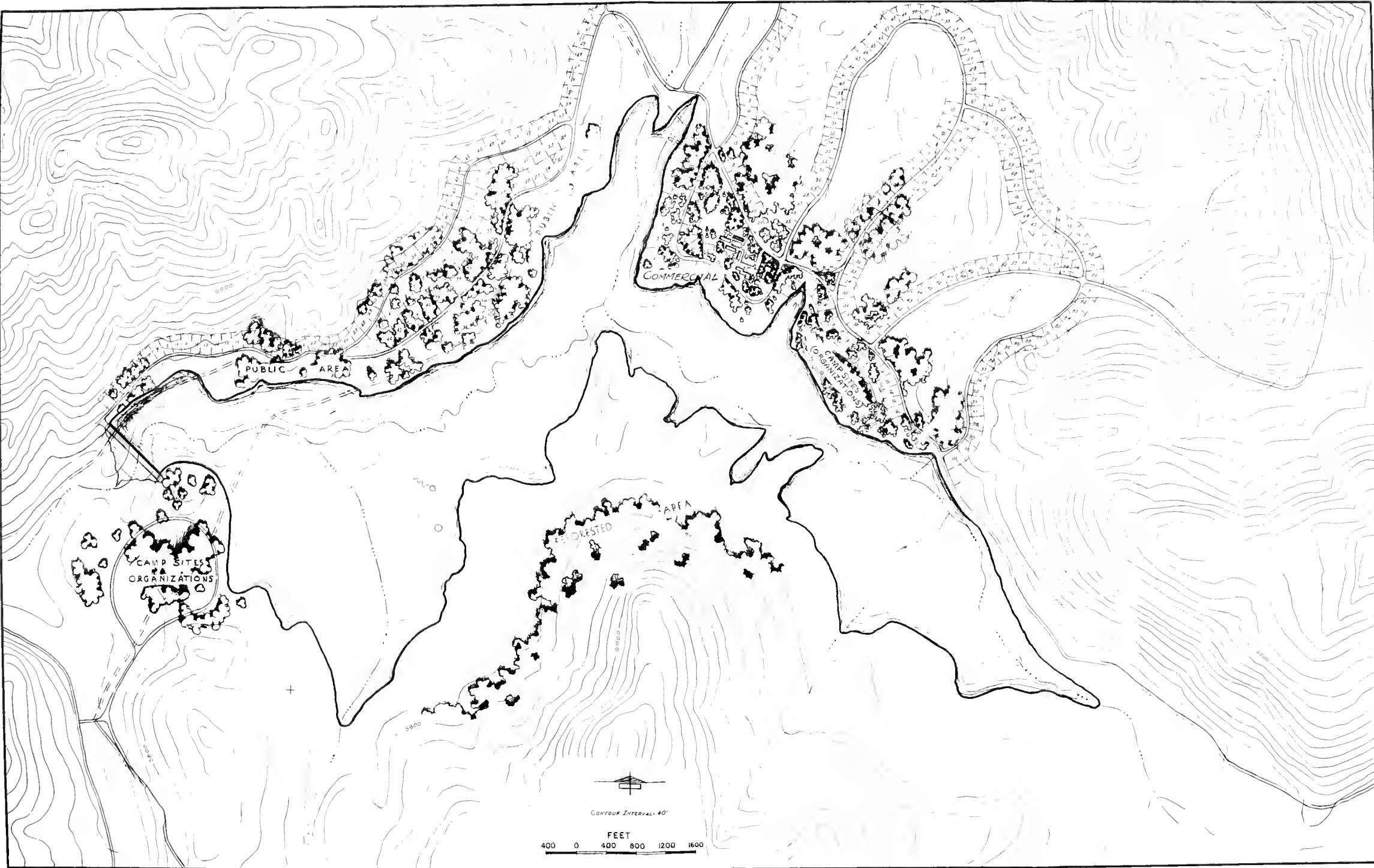
HAROLD F. WISE AND ASSOCIATES
ILLUSTRATIVE RECREATIONAL SITE PLAN FOR ANTELOPE VALLEY RESERVOIR



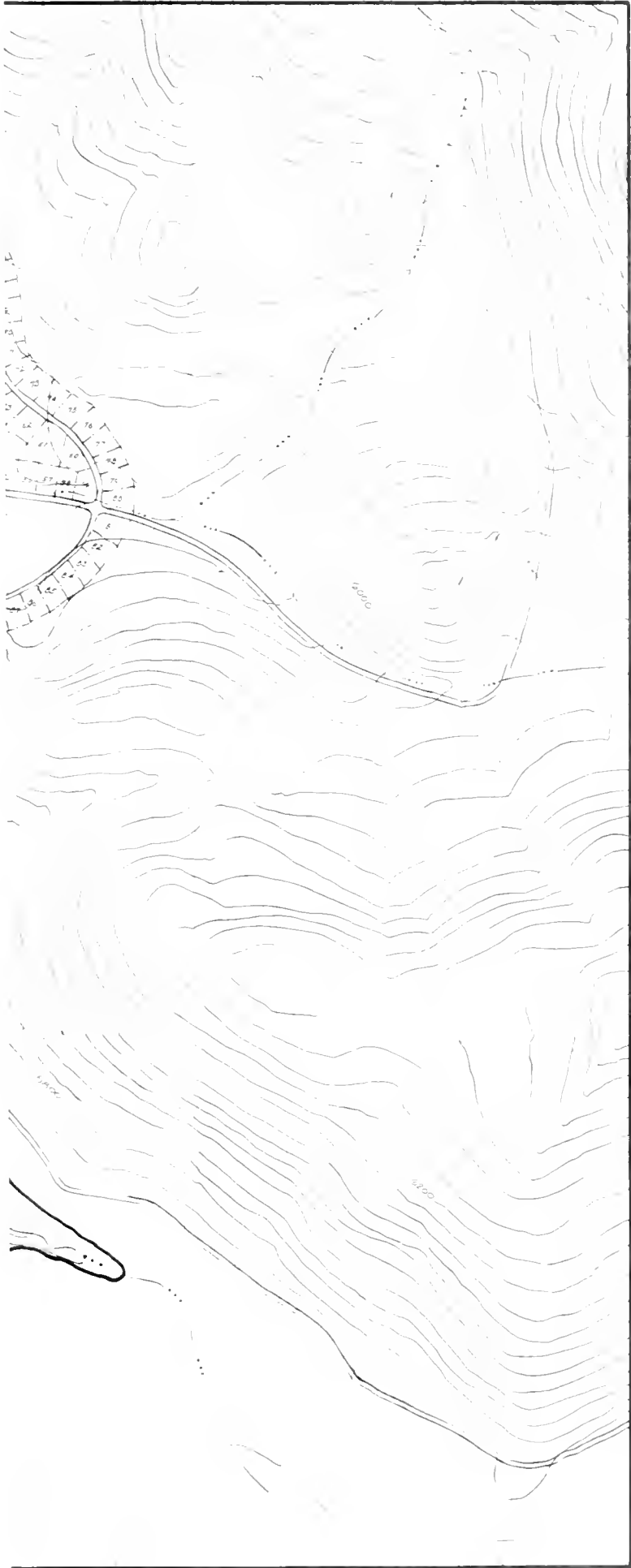


HAROLD F. WISE AND ASSOCIATES
ILLUSTRATIVE RECREATIONAL SITE PLAN FOR ABBEY BRIDGE RESERVOIR





HAROLD F. WISE AND ASSOCIATES
ILLUSTRATIVE RECREATIONAL SITE PLAN FOR DIXIE REFUGE RESERVOIR







HAROLD F. WISE AND ASSOCIATES
ILLUSTRATIVE RECREATIONAL SITE PLAN FOR FRENCHMAN RESERVOIR

APPENDIX B

COST ESTIMATES

APPENDIX B

COST ESTIMATES

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COST ESTIMATES

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ESTIMATED CAPITAL COST OF FRENCHMAN PROJECT

(Based on prices prevailing in fall of 1956)

Elevation of crest of dam:	Storage capacity of reservoir to
5,600 feet, U.S.G.S. datum	spillway crest: 50,000 acre-feet
Elevation of spillway crest:	Discharge capacity of spillway with
5,588 feet	6.2-foot residual freeboard:
Height of dam above stream bed:	5,700 second-feet
119 feet	

Item	Quantity	Unit price	Cost
Frenchman Dam			
Diversion and care of stream		\$lump sum	\$ 10,000
Stripping and preparation of foundation			
Common	2,900 cu.yd.	0.50	1,500
Jointed rock	7,700 cu.yd.	2.00	15,400
Grouting		lump sum	17,100
Embankment			
Impervious	97,900 cu.yd.	0.82	80,300
Pervious	235,740 cu.yd.	1.50	353,600
Filter	16,960 cu.yd.	3.00	50,900
			\$528,800
Spillway			
Excavation	39,015 cu.yd.	1.50	58,500
Concrete	239 cu.yd.	60.00	14,300
Reinforcing steel	23,900 lb.	0.15	3,600
Grout		lump sum	7,100
			83,500
Outlet Works			
Excavation			
Trench	763 cu.yd.	5.00	3,800
Outlet channel	800 cu.yd.	3.00	2,400
Welded steel pipe	43,680 lb.	0.25	10,900
Concrete			
Structural	46 cu.yd.	90.00	4,100
Pipe encasement	240 cu.yd.	25.00	6,000
Earth backfill	410 cu.yd.	1.00	400
Reinforcing steel	34,300 lb.	0.15	5,200
Structural steel	9,000 lb.	0.25	2,300
Miscellaneous metal	600 lb.	0.20	100
Gate valves		lump sum	9,000
Howell-Bunger valve		lump sum	14,400
			<u>58,600</u>
Subtotal			\$670,900
Engineering and administration, 15%			\$100,650
Contingencies, 15%			100,650
Interest during construction, 3% per annum			<u>13,100</u>
TOTAL			\$885,300
Lands, easements, and rights of way			\$540,500
Relocation of public utilities			43,200
Initial expenditure for public recreation			<u>62,500</u>
TOTAL INITIAL CAPITAL COST			\$1,531,500

ESTIMATED CAPITAL COST OF GRIZZLY VALLEY PROJECT

(Based on prices prevailing in fall of 1956)

Elevation of crest of dam:	Storage capacity of reservoir to
5,786 feet, U.S.G.S. datum	spillway crest: 80,000 acre-feet
Elevation of spillway crest:	Discharge capacity of spillway with
5,775 feet	6.4-foot residual freeboard:
Height of dam above stream bed:	3,100 second-feet
123 feet	

Item	Quantity	Unit price	Cost
<u>Grizzly Valley Dam</u>			
Diversion and care of stream		\$lump sum	\$20,000
Stripping	41,300 cu.yd.	2.00	82,600
Foundation treatment	32,900 sq.ft.	0.11	3,600
Grouting		lump sum	13,500
Grout cap	135 cu.yd.	30.00	4,100
Embankment			
Impervious	58,100 cu.yd.	0.67	38,900
Semipervious	149,300 cu.yd.	0.60	89,600
Filter	5,600 cu.yd.	0.75	4,200
Rock toe and riprap (from salvage)	17,800 cu.yd.	1.00	17,800
			\$274,300
<u>Spillway</u>			
Excavation			
Approach	8,400 cu.yd.	2.00	16,800
Transition and chute	4,500 cu.yd.	3.00	13,500
Concrete			
Weir, walls, and slab	411 cu.yd.	44.00	18,100
Structural	5 cu.yd.	90.00	500
Reinforcing steel	41,500 lb.	0.15	6,200
Tile drains	600 lin.ft.	4.00	2,400
			57,500
<u>Outlet Works</u>			
Excavation			
Trench	912 cu.yd.	5.00	4,600
Inlet structure	406 cu.yd.	2.00	800
Welded steel pipe	93,000 lb.	0.30	27,900
Concrete			
Structural	46 cu.yd.	90.00	4,100
Pipe encasement	433 cu.yd.	45.00	19,500
Reinforcing steel	74,200 lb.	0.15	11,100
Miscellaneous metal	9,900 lb.	0.30	3,000
Gate valves		lump sum	9,000
Howell-Bunger valve		lump sum	18,900
			<u>98,900</u>
Subtotal			\$430,700

ESTIMATED CAPITAL COST OF GRIZZLY VALLEY PROJECT (continued)

Item	Quantity	Unit price	Cost
Engineering and administration, 15%			\$ 64,500
Contingencies, 15%			64,500
Interest during construction, 3% per annum			<u>8,400</u>
TOTAL, GRIZZLY VALLEY DAM			\$ 568,100
<u>Grizzly Valley Main Canal</u>			
Intake structure		lump sum \$ 6,500	
Canal			
Sec. A (Q = 86.7 cfs)			
Part 1	25,000 lin.ft.	7.12	178,000
Part 2	24,100 lin.ft.	6.06	146,000
Sec. B (Q = 73 cfs)	8,000 lin.ft.	5.87	46,000
Sec. C (Q = 45 cfs)	14,000 lin.ft.	4.87	68,200
Sec. D (Q = 17 cfs)	16,500 lin.ft.	3.81	62,900
Appurtenant features		lump sum	67,000
Subtotal			\$ 574,600
Engineering and administration, 10%			57,500
Contingencies, 15%			86,200
Interest during construction, 3% per annum			<u>10,800</u>
TOTAL, GRIZZLY VALLEY MAIN CANAL			\$ 729,100
Lands, easements, and rights of way for Grizzly Valley Dam and Reservoir			\$ 320,000
Relocation of public utilities			27,900
Initial expenditure for public recreation facilities			<u>71,300</u>
TOTAL INITIAL CAPITAL COST			\$1,716,400

ESTIMATED CAPITAL COST OF ALTERNATIVE GRIZZLY VALLEY RECREATION PROJECT

(Based on prices prevailing in fall of 1956)

Elevation of crest of dam:	Storage capacity of reservoir to
5,774 feet, U.S.G.S. datum	spillway crest: 44,000 acre-feet
Elevation of spillway crest:	Discharge capacity of spillway with
5,763 feet	6.4-foot residual freeboard:
Height of dam above stream bed:	2,465 second-feet
101 feet	

Item	Quantity	Unit	price	Cost
<u>Grizzly Valley Dam</u>				
Diversion and care of stream		\$lump sum		\$20,000
Stripping	10,460	cu.yd.	2.00	20,900
Preparation of foundation	17,865	sq.ft.	0.11	2,000
Grouting		lump sum		17,200
Grout cap	100	cu.yd.	30.00	3,000
Embankment				
Impervious	41,810	cu.yd.	0.67	28,000
Semipervious	96,490	cu.yd.	0.60	57,900
Filter	5,470	cu.yd.	0.75	4,100
Rock toe and riprap (from salvage)	9,890	cu.yd.	1.00	9,900
				\$163,000
<u>Spillway</u>				
Excavation				
Approach	8,140	cu.yd.	2.00	16,300
Transition and chute	5,690	cu.yd.	2.50	14,200
Concrete				
Weir, walls, and slab	470	cu.yd.	45.00	21,200
Structural	20	cu.yd.	90.00	1,800
Reinforcing steel	38,600	lb.	0.15	5,500
Tile drains	980	lin.ft.	4.00	3,900
				62,900
<u>Outlet Works</u>				
Excavation	670	cu.yd.	5.00	3,400
Welded steel pipe	40,900	lb.	0.30	12,300
Concrete				
Structural	46	cu.yd.	90.00	4,100
Pipe encasement	222	cu.yd.	25.00	5,600
Reinforcing steel	31,400	lb.	0.15	4,700
Miscellaneous metal	9,900	lb.	0.20	2,000
Gate valves		lump sum		5,000
Howell-Bunger valve		lump sum		11,200
				<u>48,300</u>
Subtotal				\$274,200

ESTIMATED CAPITAL COST OF ALTERNATIVE GRIZZLY VALLEY
RECREATION PROJECT
(continued)

Item	:	Quantity	:	Unit price	:	Cost
Engineering and administration, 15%						\$ 41,150
Contingencies, 15%						41,150
Interest during construction, 3% per annum						<u>5,300</u>
TOTAL						\$361,800
Lands, easements, and rights of way						320,000
Relocation of public utilities						27,900
Initial expenditure for public recreation facilities						<u>62,300</u>
TOTAL INITIAL CAPITAL COST						\$772,000

ESTIMATED CAPITAL COST OF INDIAN CREEK RECREATION PROJECT

(Based on prices prevailing in fall of 1956)

Elevation of crest of dam:	Storage capacity of reservoir to
5,016 feet, U.S.G.S. datum	spillway crest: 21,600 acre-feet
Elevation of spillway crest:	Discharge capacity of spillway with
5,000 feet	5.5-foot residual freeboard:
Height of dam above stream bed:	3,400 second-feet
93 feet	

Item	Quantity	Unit	price	Cost
<u>Antelope Valley Dam</u>				
Diversion and care of stream			\$lump sum	\$10,000
Stripping and preparation of foundation	20,800	cu.yd.	2.00	41,600
Grouting			lump sum	17,300
Embankment				
Impervious	38,700	cu.yd.	0.75	29,000
Pervious	143,000	cu.yd.	0.65	93,000
Filter	15,900	cu.yd.	1.50	23,900
Riprap	3,600	cu.yd.	2.00	7,200
				\$222,000
<u>Spillway</u>				
Excavation	10,525	cu.yd.	1.50	15,800
Concrete	225	cu.yd.	50.00	11,300
Reinforcing steel	22,500	lb.	0.15	3,400
Tile drains	480	lin.ft.	4.00	1,900
				32,300
<u>Outlet Works</u>				
Excavation	470	cu.yd.	5.00	2,300
Welded steel pipe	30,600	lb.	0.30	9,200
Concrete				
Structural	41	cu.yd.	90.00	3,700
Pipe encasement	225	cu.yd.	25.00	5,600
Reinforcing steel	6,200	lb.	0.15	900
Miscellaneous metal	9,900	lb.	0.30	3,000
Gate valves			lump sum	3,500
Howell gate valve			lump sum	7,600
				<u>35,800</u>
Subtotal				\$290,100
Engineering and administration, 15%				\$ 43,500
Contingencies, 15%				43,500
Interest during construction, 3% per annum				<u>8,700</u>
TOTAL, ANTELOPE VALLEY DAM				\$385,800

ESTIMATED CAPITAL COST OF INDIAN CREEK
RECREATION PROJECT (continued)

Elevation of crest of dam: 5,433 feet, U.S.G.S. datum	Storage capacity of reservoir to spillway crest: 11,100 acre-feet
Elevation of spillway crest: 5,420 feet	Discharge capacity of spillway with 5.5-foot residual freeboard:
Height of dam above stream bed: 71 feet	7,750 second-feet

Item	Quantity	Unit price	Cost
<u>Abbey Bridge Dam</u>			
Diversion and care of stream		\$lump sum	\$ 10,000
Stripping and preparation of foundation	7,200 cu.yd.	2.50	18,000
Grouting		lump sum	17,300
Embankment			
Impervious	32,000 cu.yd.	0.80	25,600
Pervious	55,200 cu.yd.	2.00	110,400
Filter	8,600 cu.yd.	4.00	34,400
			\$215,700
<u>Spillway</u>			
Excavation	27,900 cu.yd.	1.00	27,900
Concrete			
Weir	283 cu.yd.	35.00	9,900
Walls	380 cu.yd.	50.00	19,000
Slab	345 cu.yd.	40.00	13,800
Reinforcing steel	100,000 lb.	0.15	15,000
Gravel drain	175 cu.yd.	4.00	700
			86,300
<u>Outlet Works</u>			
Excavation	146 cu.yd.	5.00	700
Welded steel pipe	7,600 lb.	0.30	2,300
Concrete			
Structural	41 cu.yd.	90.00	3,700
Pipe encasement	88 cu.yd.	35.00	3,100
Reinforcing steel	21,400 lb.	0.15	3,200
Structural steel	9,300 lb.	0.30	2,800
Miscellaneous metal	600 lb.	0.20	100
Gate valves		lump sum	3,000
Howell-Bunger valve		lump sum	7,200
			<u>26,100</u>
Subtotal			\$328,100
Engineering and administration, 15%			\$ 49,200
Contingencies, 15%			49,200
Interest during construction, 3% per annum			<u>6,400</u>
TOTAL, ABBEY BRIDGE DAM			\$432,900

ESTIMATED CAPITAL COST OF INDIAN CREEK
RECREATION PROJECT (Continued)

Elevation of crest of dam:	Storage capacity of reservoir to
5,751 feet, U.S.G.S. datum	spillway crest: 16,100 acre-feet
Elevation of spillway crest:	Discharge capacity of spillway with
5,740 feet	5.6-foot residual freeboard:
Height of dam above stream bed:	2,250 second-feet
81 feet	

Item	Quantity	Unit	price	Cost
<u>Dixie Refuge Dam</u>				
Diversion and care of stream			\$lump sum	\$ 10,000
Stripping and preparation of foundation	37,600	cu.yd.	0.50	18,800
Grouting			lump sum	34,600
<u>Embankment</u>				
Impervious	269,700	cu.yd.	0.65	175,300
Filter	4,200	cu.yd.	6.00	25,200
Rock toe and riprap	45,400	cu.yd.	2.00	90,800
				\$354,700
<u>Spillway</u>				
Excavation	10,900	cu.yd.	1.00	10,900
Concrete	118	cu.yd.	50.00	5,900
Reinforcing steel	11,800	lb.	0.15	1,800
Tile drains	160	lin.ft.	6.00	1,000
Grouting			lump sum	5,600
				25,200
<u>Outlet Works</u>				
Excavation	280	cu.yd.	5.00	1,400
Welded steel pipe	24,000	lb.	0.30	7,200
<u>Concrete</u>				
Structural	41	cu.yd.	90.00	3,700
Pipe encasement	210	cu.yd.	40.00	8,400
Reinforcing steel	37,700	lb.	0.15	5,700
Miscellaneous metal	9,900	lb.	0.30	3,000
Gate valves			lump sum	4,000
Howell-Bunger valve			lump sum	7,400
				<u>40,800</u>
				\$420,700
Engineering and administration, 15%				\$ 63,100
Contingencies, 15%				63,100
Interest during construction, 3% per annum				<u>8,200</u>
TOTAL, DIXIE REFUGE DAM				\$555,100

ESTIMATED CAPITAL COST OF INDIAN CREEK
RECREATION PROJECT (Continued)

Item	Quantity	Unit price	Cost
Lands, easements, and rights of way			
Antelope Valley			\$71,900
Abbey Bridge			43,300
Dixie Refuge			17,300 \$ 132,500
Relocation of public utilities			
Antelope Valley			28,000
Abbey Bridge			83,500
Dixie Refuge			47,500 159,000
Initial expenditure for public recreation			<u>266,400</u>
TOTAL INITIAL CAPITAL COST			\$1,931,700

APPENDIX C

OPINION OF LEGISLATIVE COUNSEL

AUTHORIZATION OF
UPPER FEATHER RIVER SERVICE AREA FEATURES

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DEPUTIES

C O P Y

Sacramento, California
December 11, 1956

Honorable Pauline L. Davis
116 San Antonio Way
Sacramento, California

Authorization of Upper Feather River
Service Area Features - #3828

Dear Mrs. Davis:

QUESTION

You have asked us whether the Upper Feather Service Area features have been authorized by the Legislature as a part of the Feather River Project.

In this connection you have submitted a letter of the Controller dated November 19, 1956, a letter of understanding of the Department of Water Resources dated November 8, 1956, and a modified letter of understanding of the Department of Water Resources dated November 26, 1956.

OPINION

While it is necessary to resolve certain ambiguities in the applicable statute (Wat. C. 11260, Stats. 1956 (1st E.S.) Ch. 54) in order to arrive at a conclusion, the rules of statutory construction point to the conclusion that the Upper Feather River Service Area features are by legislative act a part of the Feather River Project. We conclude, therefore, that the proper interpretation of the 1956 statute is that the Upper Feather Service Area features have been made an authorized part of the Feather River Project.

ANALYSIS

In 1951 the Legislature added Section 11260 to the Water Code, authorizing, as a part of the Central Valley Project:

"The units set forth in publication of the State Water Resources Board entitled 'Report on Feasibility of Feather River Project and Sacramento-San Joaquin Delta Division Projects Proposed as Features of the California Water Plan,' dated May, 1951, subject to such modifications thereof as the authority may adopt...." (Ch. 1441, Stats. 1951)

This portion of Section 11260 was amended by Chapter 54 of the 1956 First Extraordinary Session to read:

"The units set forth in publication of the State Water Resources Board entitled 'Report on Feasibility of Feather River Project and Sacramento-San Joaquin Delta Division Projects Proposed as Features of the California Water Plan,' dated May, 1951, as modified in the publication of the Division of Water Resources entitled 'Program for Financing and Constructing the Feather River Project as the Initial Unit of the California Water Plan,' dated February, 1955, subject to such further modifications thereof as the authority may adopt...." (Language added by 1956 amendment underscored)

Construed in the light of the power of the Water Project Authority as indicated in both amended forms of the quoted section and otherwise (Wat. C. 11290) the question immediately arises as to the power of the Division of Water Resources to modify the Feather River Project as of the time that the division issued its report. We are not aware of any such power.

Further ambiguity arises from the 1955 division report itself. The first time modification is mentioned in the report (page 3) it is in the context of "two possible modifications," and the second time (page 3) it is in the context of "There are also presented two modifications of

the Feather River Project Aqueduct." Other language is found with respect to other features of the project, such as:

"It was found that it was advantageous to the project from operational and economic viewpoints to add to it the following features along the Feather River Project Aqueduct, not included in the original (1951) report: the San Luis Forebay, San Luis Reservoir..." (page 2)

Until Chapter VI the report does not discuss the Upper Feather River Service Area features, nor does any plate indicate any features of the Upper Feather River Service Area as part of the Feather River Project. However, that chapter opens:

"Estimates of water requirements and water development plans for the Upper Feather Service Area have been given consideration in planning the Feather River Project."

The chapter includes estimates of the capital cost requirements of various project features for the Upper Feather River Service Area.

Chapter VII is the final chapter of the report and contains the following four recommendations:

"1. Adequate funds be appropriated by the Legislature to initiate construction of the Feather River Project (the initial unit of The California Water Plan) as presented in this report.

"2. The Legislature consider enactment of legislation for submission to the electorate of a proposal to authorize issuance of bonds in the aggregate amount of \$1,500,000,000 to finance construction of the Feather River Project in a step construction program.

"3. Upstream features of the North, Middle and South Forks of the Feather River, as set forth in Chapter 6 of this report, be included in the Feather River Project.

"4. Further works of The California Water Plan be financed and constructed in accordance with a predetermined schedule in order that the excess water supplies of the State be developed and made available for beneficial use as and when the need arises."

There thus being ambiguity as to the meaning to be attributed to "modified" as used in Section 11260 of the Water Code as amended in 1956 with respect to the report of the Division of Water Resources, it is appropriate that additional factors be considered in arriving at the proper interpretation of that word in accordance with established rules of statutory construction. (Stockton Savings & Loan Bank v. Massanet (1941), 18 Cal. 2d 200, 207.)

(a) The General Meaning of the Words Used

As pointed out, the Division of Water Resources had no power to modify the Feather River Project and in fact cannot reasonably be said to have purported to have done so. When speaking of the project as planned or in presenting modifications, the reasonable import of the report is that the Division of Water Resources acted in its role of advisor to the Water Project Authority (Wat. C. 11160) and proposed to that body certain modifications.

In its conclusions (Chapter VII) the division recommended adequate funds for the Feather River Project as presented in the report and also recommended that upstream features of the Feather River be included in the Feather River Project. So far as the presenting of the project and the recommending for inclusion in the project are concerned we find little difference. Webster's New International Dictionary, Second Edition (1951), defines recommend as to commend or bring forward as meriting consideration, and present as the bringing or introducing into the presence of someone.

To attempt to draw distinctions from these slight differences is to attribute a significance to them clearly repugnant to their lack of precision. Where a word has a popular and also a technical meaning, the courts will accord it its popular meaning, unless the mere nature of the subject indicates or the context suggests that it is employed in its technical sense (City of Pasadena v. Railroad Commission of the State of California

(1920), 183 Cal. 526, 532). The analogy is pertinent here, particularly in view of the impossibility of applying the technical meaning.

(b) Contemporaneous Administrative Construction

You have made reference to a letter of the State Controller, dated November 19, 1956, which points out that as of that date approximately \$1468.07 had been expended by the Department of Water Resources from the appropriation made by Item 419.6 of the Budget Act. Since as heretofore pointed out that appropriation could only be lawfully expended if the project was authorized, there is indicated the contemporaneous administrative interpretation of the Department of Water Resources and of the State Controller that the Upper Feather River Service Area features had been included in the authorized Feather River Project.

The letters of understanding dated November 8 and November 26, 1956, are in effect requests of the Department of Water Resources for Department of Finance approval (Gov. C. 14034) of the transfer by the State Controller of the moneys appropriated by Item 419.6 to the Water Resources Revolving Fund. Conceding that they may be further evidences of the recognition by the Department of Water Resources of the authorization of the project, their effect is cumulative. Until acted upon by the Department of Finance, there is no evidence of that department's view of the matter. However, the action of the State Controller and the Department of Water Resources, almost upon the taking effect of Section 11260, as amended in 1956, does appear to be a contemporaneous administrative interpretation of the effect of a statute, which would be given weight by the courts (City of Los Angeles v. Rancho Homes, Inc. (1953), 40 Cal. 2d 764, 770).

Very truly yours,

Ralph N. Kleps
Legislative Counsel

By
J. D. Strauss
Deputy

JDS/1a

VIEWS AND RECOMMENDATIONS OF INTERESTED AGENCIES

APPENDIX D

OF

INVESTIGATION OF UPPER FEATHER RIVER BASIN DEVELOPMENT

INTERIM REPORT ON ENGINEERING, ECONOMIC,
AND FINANCIAL FEASIBILITY OF INITIAL UNITS

GOODWIN J. KNIGHT
Governor



HARVEY O. BANKS
Director of Water Resources

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STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
DIVISION OF RESOURCES PLANNING

VIEWS AND RECOMMENDATIONS OF INTERESTED AGENCIES

APPENDIX D

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Director of Water Resources

APRIL, 1957

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FOREWORD

At the direction of the Legislature of the State of California, and in accordance with Section 12623 of the Water Code, the State Department of Water Resources held a joint hearing with the State Water Board on February 14, 1957, in Quincy, California, to secure comments on the preliminary edition of Bulletin No. 59, "Investigation of Upper Feather River Basin Development, Interim Report on Engineering, Economic, and Financial Feasibility of Initial Units".

This appendix report contains the comments presented verbally and in writing at the public hearing. It also contains the written views and recommendations of interested agencies submitted to the Director of the Department of Water Resources and the State Water Board following the date of the hearing, but prior to the publication date of this appendix report.

STATEMENTS REGARDING BULLETIN NO. 59
DELIVERED AT PUBLIC HEARING
QUINCY, CALIFORNIA, FEBRUARY 14, 1957

CALIFORNIA DEPARTMENT OF NATURAL RESOURCES
DIVISION OF BEACHES AND PARKS

Statement by
Newton B. Drury, Chief
Presented by
Robert B. Hatch

The preliminary investigation of the Upper Feather River Service areas by the Division of Beaches and Parks was started shortly after July 1st of 1956. Work is nearing completion on the authorized reservoir sites; namely, Antelope Valley, Abbey Bridge, Dixie Refuge, Frenchman and Grizzly Valley reservoirs. Preliminary work has been done on Meadow Valley, Genesee, Squaw Queen, Nelson Point and Sheep Camp reservoirs. Studies will be completed as needed.

A Factual Report is scheduled to be presented to the State Park Commission for their review and consideration at their March meeting.

The planning staff of this Division is impressed with the recreation potential of the area in general, as well as with the problems caused by climate, geographic location and existing land use and management. Construction of these reservoirs will enhance the area for recreationists and act as focal points for recreation activities. One of the major deficiencies of the area is the lack of adequate roads to support continued commercial traffic and increased recreation traffic safely and without conflict. Almost all roads require widening, new alignment and a general raising of standards. Some right-of-way problems can be expected and eventually a paving program will be required.

All facts compiled indicate recreation as an increasingly large attraction and economic factor in the Upper Feather River Service Area, in the opinion of the planners of this Division.

CALIFORNIA DEPARTMENT OF FISH AND GAME

Statement by
Seth Gordon, Director
Presented by

Ed V. Dwyer, Fisheries Biologist III

Although some of its personnel have worked closely with the Department of Water Resources in the investigations preparatory to compilation of Bulletin 59, entitled, "Investigation of Upper Feather River Basin Development: Interim Report on Engineering, Economic, and Financial Feasibility of Initial Units", the Department of Fish and Game has had opportunity to review it only in a very preliminary manner.

Some features of the Upper Feather River Basin Development deserve more consideration than was possible in the limited time available, and therefore the Department of Fish and Game desires to withhold comment on these features at this time.

Bulletin 59 includes projects for the improvement of fishing and recreation, a long awaited and greatly needed concept in the development of the State's water resources, and one which the Department of Fish and Game heartily endorses.

Agricultural, industrial and population growth in California in recent years have brought to bear great pressures on the natural resources of the State. Among these resources, the one of most immediate concern to the Department is water and the storage, conservation and use of water.

The Fish and Game Commission has stated its policy regarding water storage developments. This policy dictates so clearly the position of the Department in this hearing that it should be read into the record. A statement of this policy resolution follows:

"WHEREAS, The California Fish and Game Commission recognizes the need for the orderly development of water resources of California; and

WHEREAS, The pressure of the State's expanding population and industry is resulting in an unprecedented number of proposed water development projects on virtually all of its rivers; and

WHEREAS, The population of California will probably double in the next twenty-five years and the need for recreation, particularly fishing, will become increasingly acute; and

WHEREAS, Past experience has indicated that fisheries resources of vast economic importance have been permanently destroyed by poorly conceived water projects; and

WHEREAS, Most water resource developments in the past have not been multi-purpose projects for the population as a whole because the concurrent recreational and wildlife aspects have been neglected; and

WHEREAS, It will become increasingly important that fish and wildlife resources be carefully considered by the planners of water projects as more dams are proposed. now, therefore, be it

RESOLVED, That the Fish and Game Commission adopts the following policies with respect to the water resource developments of California in the future:

1. The value of water for fisheries, wildlife and recreation is fully as important as, and may in some instances outweigh, some of the other beneficial uses and should therefore be carefully considered in the planning of water resource developments.

2. The State of California should make every effort to expand and not merely attempt to preserve wildlife and recreational values which will be adversely affected by the construction of water projects.

3. All applications for water use should be carefully reviewed by those State agencies having jurisdiction thereof, and no applications should be granted unless adequate provision is made for preservation of the existing fish and wildlife resources or their replacement in kind.

4. Every effort should be made to secure recognition by the public at large and by all State agencies, of the practical and esthetic values of the State's fish, wildlife, and recreational resources.

5. It is recognized that the majority of water resource developments are essential to the economy of the State, but resulting damage to fish and wildlife resources can be minimized. The State of California should oppose any water project where the permanent loss of practical and esthetic values of its fish, wildlife and recreational resources will outweigh or will approximate the financial return to the users of the project during its economic life."

The importance of recreational fishing in the United States can be shown by a report published in 1956 by the U. S. Fish and Wildlife Service. This report indicates that in 1955, almost twenty-one million fishermen spent more than two billion dollars to enjoy almost four hundred million man-days of recreation. In the three Pacific States about two and a quarter million fishermen spent more than two hundred and twenty million dollars to enjoy about forty-six million man-days of recreation.

In California in 1955, about ten per cent of the population, about one million three hundred and three thousand people, bought angling licenses. This represents only a portion of the total number of fishermen in California since children and servicemen are not required to purchase angling licenses. The percentage of the population in California purchasing angling licenses has been increasing steadily

so we anticipate that in the future an increased percentage of the population will buy fishing licenses.

It must be emphasized that fishing and associated recreation now play an important part in the welfare of the people of the State, and will play an increasing part in their welfare as the economy develops to afford more leisure time and a greater margin of the economy expendable on recreation. The area in the Upper Feather River Service Area under consideration is of extreme importance to the recreational resource of California. Access is good, the recreational season is relatively long, and the topography of the country is suitable for increased recreational use. The streams generally are suitable for trout fisheries, and are susceptible of ordinary fisheries management practices. The late summer flows, however, are a limiting factor in trout production, and the carrying capacity of the streams is reduced, both for fish and for fishermen. In this northeastern section of Plumas County, an area of about seven hundred square miles, there are no lakes nor fishable reservoirs.

It is apparent that the use of this area by people seeking recreation would be tremendously increased by the creation of lakes and the maintenance of stream flows as contemplated in this report.

In the summer of 1956 the Department of Water Resources financed, and the Department of Fish and Game conducted a survey in the Upper Feather River Service Area to determine the actual use by anglers of the streams to be affected by the five dams proposed as the initial units of the water development in this area. In the area of the Indian Creek Project, comprising Antelope Valley Dam on Indian Creek, Dixie Refuge Dam on Last Chance Creek, Abbey Bridge Dam on Red Clover Creek, and the stretch of Indian Creek through Genesee Valley to Taylorsville, there were approximately 9,000 man-days spent in angling. In the area below Frenchman Dam and Grizzly Valley Dam, in the Middle Fork drainage area as far west as Sloat, there were approximately 20,000 man-days spent in angling. It is estimated that these anglers spent approximately two hundred and seventy thousand dollars (\$270,000) on their sport. Along with these anglers there were others in their parties who did not fish, bringing the total visitor-days in these areas to approximately 44,000. The expenditure of time and money of these people can be credited primarily to the attraction of fishing in live streams. It is important for the purposes of this hearing to remember that only 11% of these visitors originated in Plumas County, that 47% came from the Bay Area, and that 19% came from Southern California. This distribution indicates that development of the recreational resources of this area will benefit not only the local people and business interests, but will benefit the welfare of the entire population of California.

Impressive as the figures of present use might be, they are relatively insignificant when compared to the predicted use. The assumed ultimate population of California less than a hundred years from now is 45 million people. In considering construction of water conservation projects, an economic period of 50 years is adopted for judgement of value. California population fifty years from now will be about 35 million or more than twice our present population. In these fifty years we will have gained a higher standard of living, including four or even three day work week, longer vacations, and better transportation. At

the same time, we will find less opportunity for outdoor recreation in the vicinity of the cities where most of these people will live.

The prediction of the use of the area considered then, is based on a conservative estimate of the saturation level of anglers per mile of stream at this distant time. The stream in an improved condition will accommodate more fishermen than in an unimproved condition. The difference will be creditable to the presence and operation of these proposed water conservation projects.

The method of prediction used by the Department of Fish and Game is described as follows: A curve of probable increased use with the projects was drawn from the present number to the ultimate number. A depression was made in the early years of the curve to allow for construction periods for public and private facilities such as camps, resorts, hotels and motels. A second depression was made in the curve to allow for delay in universal adoption of the short work week and the year-round operation of city schools. A second curve was drawn which depicted the use of these streams without the proposed projects. The difference of use between the conditions with and without the projects was taken for the first fifty years. The tremendous use of the streams during the second fifty years was disregarded as being irrelevant to this type of analysis. It must be remembered, however, that this second half-century will find even greater use than the first half.

The average annual number of angler-days creditable to the project in the fifty years is predicted to be as follows:

Indian Creek below Antelope Valley Dam	32,000
Last Chance Creek below Dixie Refuge Dam	128,000
Red Clover Creek below Abbey Bridge Dam	42,000

The average annual number of angler-days along Indian Creek down as far as Taylorsville is predicted to be 107,000, giving a total benefit of 309,000 average annual angler-days. These numbers are considered conservative, or minimal, and the actual increase will undoubtedly be greater than this.

In view of these facts and predictions, the Department of Fish and Game concurs in the recommendation of the Department of Water Resources that the Indian Creek Project be built and operated for recreation and stream flow maintenance.

The two projects proposed in the Middle Fork drainage area are of different character and present different possibilities of use. The Department wishes to defer comment on the proposed Frenchman Project until some later time.

The economy and welfare of the State would derive great benefits from the proposed Grizzly Valley Project, if it were built and operated for recreation and stream flow maintenance. Operated for these purposes, it would provide benefits of approximately 13 times the cost, as estimated by the Department of Fish and Game, using the net benefit formula described in Bulletin #59. The Department of Fish and Game recommends that the proposed Grizzly Valley Project be built and operated for recreation and stream flow maintenance.

The Department of Fish and Game appreciates the opportunity of making this presentation, and of making known some of its views and comments on Bulletin #59.

COUNTY OF LASSEN

Letter from
Paul Milton, Chairman
Water Resources Committee

The Lassen County Water Board wholeheartedly endorse Mr. Donnenwirth's, Chairman of the County Board of Supervisor's of Plumas County, statements in regard to the development of the Upper Feather River Basin Projects. We suggest further reservation of time for future study and recommendations.

LAST CHANCE CREEK WATER DISTRICT

Statement by
William E. Ryan, President
Board of Directors

My name is Ryan, Director of the Last Chance Water District, Last Chance Creek Water District, relative to the Frenchman Project. There is, of course, the water users who are willing to negotiate with the proper agency for water purchase contracts, when the policy and the price, cost, repayments, is better defined by the Legislature.

On the Grizzly, we are willing to also contract or negotiate for that part of the water that is envisioned to be brought into Last Chance Creek Water District. Now, there is a large service area lying outside, contemplated service area, lying outside of the Last Chance Creek District, and we can't speak for those people. We would like time, perhaps two weeks, to submit a written statement of our position and have it become a part of the record. Will we be granted permission to do that?

MR. BERRY: That will be perfectly satisfactory, Mr. Ryan, yes.

Do you have any questions, Mr. Volk?

MR. VOLK: I am not very well versed in this area, but I am under the impression there isn't additional water for much outside land? I might be mistaken in that?

MR. RYAN: Would you restate that, please? I didn't hear you. I hear bad.

MR. VOLK: You mentioned the fact there are certain areas outside of your present boundaries, which would like water and you couldn't speak for them. I am just under the impression that there is not a surplus of water for lands outside?

MR. RYAN: You are thinking of the Grizzly?

MR. VOLK: Yes.

MR. RYAN: As you look at the map, there is a lot of area between the ditch on the north boundary of the valley, and that part there that is irrigable land. It is closer to the source of supply. It is possible that those people would wish to form a district and they probably are people entitled to that water as we are for their development. We would take that part of the water, and perhaps more if negotiated, but we are not trying to eliminate those people as possible users.

MR. VOLK: One thing I would like to point out in connection with your costs for irrigation: you will have certain costs within your district, distribution canals that should be taken into consideration in your total cost of water.

MR. RYAN: That's right; but that would be a district problem, one that we would accept ourselves.

OROVILLE CHAMBER OF COMMERCE

Telegram from
L. D. Ohlson, Chairman
Water Resources Committee

We wholeheartedly support State construction earliest possible time proposed five upstream water development projects in Plumas County. In addition to providing local areas with benefits to which they are entitled, these projects will produce extensive recreational benefits for sportsmen throughout the State and will comprise valuable units of the Feather River Project by regulating stream flow thereby aiding flood control.

PACIFIC GAS AND ELECTRIC COMPANY

Statement by
Barton W. Shackelford

We appreciate this opportunity to appear before representatives of the Department of Water Resources and the State Water Board to present our comment on the February 1957 Preliminary Edition of Bulletin No. 59, entitled, "Investigation of Upper Feather River Basin Development, Interim Report on Engineering, Economic and Financial Feasibility of Initial Units." These comments are however preliminary in nature since a copy of Bulletin 59 was obtained by the Company only this morning and for that reason the Company has not had sufficient time to adequately review the conclusions set forth in the interim report.

Our appearance here is solely for the purpose of advising the Department of Water Resources and the State Water Board of certain facts which the Pacific Gas and Electric Company feels should be made part of the record and taken into consideration before final adoption of the report and recommendations by the Department are made.

The Company owns certain water rights and facilities in connection with its comprehensive water and power development on the North Fork Feather River. In addition, the Company, as custodian for public service use, owns certain water rights and facilities in connection with its Western Canal which diverts water from the Feather River below Oroville for irrigation purposes. We recognize, however, that the State Water Rights Board will have jurisdiction in the matter of issuance of Water Right Permits relating to the five reservoir projects set forth in this interim report and that said Board would be the proper forum to which to submit matters of water rights. However, since the Department of Water Resources is now the custodian of certain Water Right Applications made in furtherance of these five Projects, we believe comment on this matter is pertinent. We assume that there will be no interference with the rights associated with existing projects and projects under construction by the Company. Because we have not seen detailed operation studies of the proposed projects considered in the report, we are unable at this time to determine to what extent, if any, the operation of these reservoir projects will interfere with Company's vested rights. In accordance with law, this Company is charged with the responsibility of protecting all rights that are used and useful in the public service. We do not have the right to deviate from this obligation.

In the Feather River basin alone, the Company has constructed water development facilities costing over \$100 million and the Company plans to expend in excess of another \$100 million on facilities now under construction. With these figures in mind, it is obvious that the Company would be concerned if the operation of the five proposed reservoirs would impair the productive performance of the Company's downstream facilities. We therefore urge the Department and the State Water Board to take

no action to adopt this report until sufficient time has been allowed for interested parties to review the report to determine if there may be interference with vested water rights.

The Company has always supported sound water development projects. The Feather River Basin waters are a valuable resource to the inhabitants of California and should be developed when needed. As prerequisites to authorization of construction of the initial units of the Upper Feather River Basin Development as set forth in this interim report, it is essential that interested parties be allowed sufficient time to review the report to determine if there may be interference with vested rights and that the economic feasibility be clearly demonstrated.

I would also like to request permission to file a written further comment which we may wish to do after studying the report. I submit that we might like to have a month, rather than two weeks, if that is agreeable with the board.

PLUMAS COUNTY BOARD OF SUPERVISORS

Statement by
Clair Donnenwirth, Chairman

We are wholeheartedly in agreement with the recommendations of your report "Bulletin No. 59 -- Investigation of Upper Feather River Basin Development", with the following comments:

1. Your recommendation No. 1 has to do with authorizing the Upper Feather River Projects as features of the Feather River Project. It is our understanding, based on opinion of the Legislative Counsel, that the Upper Feather River Projects have already been authorized as part of the overall Feather River Project.

We understand that this conclusion was also recognized by the Department of Water Resources and the Department of Finance before Legislative Committee Hearings in January, 1957.

2. We agree with your recommendation No. 4, which has to do with the obtaining of water rights prior to any construction project.

It has always been our understanding that regardless of the project, water rights were needed prior to construction. We wonder why this matter is specifically incorporated in your recommendations for the Upper Feather River Projects.

May we take this opportunity to express our appreciation to the personnel in the Department of Water Resources for the excellent job they have done in the preparation of Bulletin No. 59.

UNITED STATES FOREST SERVICE
PLUMAS NATIONAL FOREST

Statement by
William A. Peterson, Forest Supervisor

The Forest Service is greatly interested in the establishment of the proposed reservoirs in the Upper Feather River watershed. Where National Forest lands are needed for water storage they will be made available to the Department of Water Resources or the appropriate agency involved.

National Forest lands are used for multiple purposes including public recreation. As the reservoir program develops the Forest Service will prepare detailed plans to meet public recreation needs. Adjacent National Forest areas not required for intensive public use will be managed for grazing of livestock, growing and harvesting of timber, and maintenance and development of wildlife habitat in a manner which will protect and improve the watershed.

It is the intent that National Forest land will be developed to meet requirements for public recreation facilities.

RICHVALE IRRIGATION DISTRICT

Statement by
Alvil L. Harry, Secretary

We haven't much to say due to the fact we haven't been able to get hold of this 59 Bulletin. as you know, but we are requesting to file our comments later, and we will also have some proposals at that time.

I would like to say now, we have said it before, that we think that this upper area is entitled to all the water that they can reasonably use, and we don't want to take any of the water away if we can help it. We would like to cooperate with you, and I will say this: our door is open for a get-together, a genuine get-together, no rocks thrown, and see what we can work out. I think that is about all I care to say.

SIERRA COUNTY

Statement by
Winslow Christian, District Attorney

So far as Sierra County is concerned, we are, of course, to some extent by-standers at this point, since it is our understanding that although there may be some negligible irrigation benefit across the line into Sierra County, the major irrigation features, and also recreation features would be in Plumas County, and nevertheless we are slightly interested in the work that has been done on these initial features, since we do look forward to the time when consideration may be given to some of the other projects in Sierra County which have been considered in earlier phases of this study, and we would like to comment first, as indicating our wholehearted support of the concept of Upper Basin development on the part of the State of California, and we believe in this concept and believe it should be extended not only to these projects but to other projects in this region.

Second, we would also like to indicate our support of the basic concept of cost allocation between irrigation and recreation features that is included in this recommendation and report. That is, of course, a matter for legislative determination, and we anticipate some conflict and difficulty as to the details of that allocation, but we do endorse the basic concept that has been developed in this report.

Then, third, we would like to urge on the part of the Department of Water Resources and the State Water Board, that these agencies use their influence toward bringing the other features of this upper stream development to the stage that these five projects are now in as soon as possible.

WRITTEN STATEMENTS SUBMITTED
REGARDING BULLETIN NO. 59

STATE OF CALIFORNIA

Inter-Departmental Communication

Harvey O. Banks, Director
Department of Water Resources
P. O. Box 1079
Sacramento, California

Date: March 21, 1957

File No.

Attention: William Berry
Department of Fish and Game

Subject: Bulletin 59, Investiga-
tion of Upper Feather River
Basin Development

The Department of Fish and Game previously commented on the investigation of the Upper Feather River Basin. These comments, made at a public hearing held in Quincy on February 14, 1957, were necessarily general as the Department did not have the opportunity to review Bulletin 59 prior to the hearing. We appreciate this opportunity to submit these additional comments which are the result of a review of the Bulletin.

We feel the concept of public funds supporting that portion of the cost of a project which can be attributed to recreation benefits is extremely important to the future of the fish and wildlife resources of California. It is definitely in the public interest to maintain these resources and support the recreation associated with them. It is reassuring to us to see the recreational use of water recognized as a major important use of water after an extensive study of the drainage basin.

Indian Creek Recreation Project

The proposed Indian Creek Recreation Project would be operated to provide releases from the reservoirs for stream flow maintenance purposes in Indian, Last Chance, and Red Clover Creeks. Regulated flows in these streams would provide tremendous benefits to the people of California if their full recreation potential can be realized. It is immediately apparent to us that there are several important factors which will influence the realization of this potential. These factors should be considered by the people and their representatives at the same time they are asked to consider the concept of public funds supporting a local development of this nature for recreation. These factors are:

1. A means must be provided to protect the releases of water for streamflow maintenance from appropriation along the course of the stream. It is our understanding that at the present time these releases are subject to appropriation for other uses. The purpose of the project would be defeated unless the amount of water necessary to maintain the streams for recreation is reserved in some way.

March 21, 1957

2. The primary benefits from stream flow maintenance have been calculated with the assumption that the public would have access to the entire length of stream in which the flow is maintained. These benefits may not be realized and the public may not receive full value for the expenditure of State funds unless access is assured along each stream.

We understand that there is to be further study of the area below the Indian Creek Project to compare the value to the State of the possible Genessee Reservoir and an alternate development of Genessee Valley as a recreation area. It is apparent that maintenance of stream flow would render this valley highly desirable as a recreation area, and that the interests of the State would be served by acquisition or other assurance of public access.

Grizzly Valley Project

The Grizzly Valley Project is proposed as a single-purpose irrigation project which would produce little, if any, benefit to recreational uses of the stream below the project. The report also contains an alternate proposal for the operation of the project for maintenance of stream flows in Grizzly Creek and the Middle Fork Feather River.

We quote a sentence from page 14 of Bulletin 59, "The public interest demands that the available funds be applied in such a manner as to bring maximum returns for the moneys, resources, and energies expended." We concur in this statement and believe that it applies especially well to the alternate Grizzly Valley Recreation Project, where the estimated ratio of benefits to costs is several times greater than the ratio estimated for the Grizzly Valley Irrigation Project.

We do not believe it would be in the best public interest to sacrifice the tremendous recreational potential on Grizzly Creek and the Middle Fork Feather River. This concentrated recreational use would have an extremely important beneficial effect on the economy of the area, and this should be given further careful consideration in attempting to serve the public interest.

We understand that the streamflow maintenance benefits of the Grizzly Creek project were considered to extend only to Nelson Point on the Middle Fork Feather River. In the event a dam is to be constructed at Nelson Point by the State or some other agency, we will certainly request that the fish, wildlife, and recreational resources of the river below this dam be maintained with adequate, continuous water releases. Water developed at Grizzly Valley for stream flow purposes could be utilized to form part of the Nelson Point releases. Thus the benefits of such water would extend over many additional miles of stream.

March 21, 1957

We recommend that the State build the alternative Grizzly Valley Recreation Project. However, as a further consideration we suggest the possibility of a multi-purpose project for both irrigation and stream flow maintenance. Under this type of development both uses would take a deficiency in dry years, but one use would not have to be developed at the complete expense of the other.

Frenchman Project

Here, again we suggest additional consideration be given to the possibility of preventing losses to the fishery of Little Last Chance Creek through multi-purpose development. The quantities of water needed to maintain a live stream during the off-irrigation season need not be large in this case.

There has been no legislative consideration of the possibility that less than the five proposed projects be built. However, such a possibility must be considered, and if the proposed Frenchman or Grizzly Projects were to be constructed independently and operated solely for irrigation, the fish and game resources would suffer losses. We recommend that, in this event, a definite allotment of water be made for stream flow maintenance below either or both dams, in amounts to be determined by further study.

We wish to commend you and your staff for the quality of work displayed by this investigation and report. The farsighted recognition of the importance of recreation to the economy of the project area is exemplary from the standpoint of serving the public interest in the development of the State's water resources.

Sincerely yours,

/s/ Seth Gordon

Seth Gordon
Director

COPY

Vinton, California

26 February 1957

Mr. Harvey Banks
Division of Water Resources
Sacramento, California

Mr. Clair Hill, Chairman
State Water Board
Sacramento, California

Gentlemen:

I enclose a statement concerning Bulletin No. 59 on behalf of the Last Chance Creek Water District which I have been authorized by the Board of Directors of the District to file and forward to you. This statement is submitted pursuant to leave granted at the joint hearing of the Water Resources and State Water Board held in Quincy on February 14, 1957.

Sincerely yours,

/s/ William E. Ryan
WILLIAM E. RYAN

President, Board of Directors
Last Chance Creek Water District

Enc. 1

cc: Senator Stanley Arnold
State Capitol
Sacramento, California

Assemblywoman Pauline Davis
State Capitol
Sacramento, California

STATEMENT OF LAST CHANCE CREEK WATER DISTRICT
FILED WITH THE DEPARTMENT OF WATER RESOURCES
AND THE STATE WATER BOARD

Following an oral statement made by William E. Ryan on behalf of the Last Chance Creek Water District at the joint hearing in Quincy on February 14, 1957, the District was given leave to file a statement in writing commenting upon Bulletin No. 59 insofar as it relates to the proposed Frenchman and Grizzly Valley Reservoirs.

Status of the Last Chance Creek Water District

The Last Chance Creek Water District is a district formed under the provisions of the California Water District Act for the purpose of developing and distributing irrigation water. The District comprises lands now having adjudicated water rights in Little Last Chance Creek. The Act under which the District was organized specifically authorizes it to contract with the State of California for the purpose of developing irrigation water supplies.

Comment on the Concept of Basin Development

By implication Bulletin No. 59 assumes that integrated development of the water resources of the Feather River Basin is properly a concern of the State of California. The Board of Directors of the Last Chance Creek Water District endorses that assumption, for the following reasons:

1. All five of the projects now proposed for construction will produce substantial benefits to recreation. The provision of public recreational facilities has traditionally been a function of government. The need for such facilities, which would benefit the entire State of California, is increasing yearly.

2. The construction of the major features of the Feather River Project has been undertaken as a responsibility of the State, and there is general agreement that it is a proper concern of the State of California to alleviate water deficiencies in Central and Southern California. Sierra Valley, though it is part of the watershed of the Feather River, is an area of deficient water supply. The position of the inhabitants of this Valley is in no way different from that of residents of other areas to be served by the Feather River Project: we all need water, and we are all willing to pay a reasonable price to get water.

Comment on Proposed Cost Allocations

One of the most interesting features of Bulletin No. 59 is its discussion of the problem of allocating the cost of any

particular project between irrigation and other functions. Although basic policy in this regard remains to be determined by the Legislature, the District concurs with Bulletin No. 59 in the following conclusions and recommendations:

1. The State should assume the cost of providing for lands, easements, and rights of way, and of relocating public utilities.

2. The costs apportioned to recreation and flood control will be incurred in connection with State functions, and therefore should not be reimbursable by water users.

3. The costs apportioned to irrigation should be reimbursed with interest at 3%, over a 50 year repayment period.

Readiness of District to Negotiate for Purchase of Water

Land owners within the Last Chance Creek Water District can beneficially use all of the additional irrigation water proposed to be developed by the Frenchman Project. The District is therefore ready and willing to enter into negotiations with the State of California for the purchase of Frenchman Project water. While the District is not prepared to enter into any binding commitment until the directors have made further cost and benefit studies, the Board of Directors offers the following comments concerning questions which will arise in connection with such negotiations:

1. It would be desirable to have a determination from the Legislature before negotiations are entered into concerning basic policies of cost allocation and reimbursement.

2. It would appear that the cost of project water as set forth in Bulletin No. 59 would be the maximum that could be borne by the land owners in the Last Chance Creek Water District. This is for the reason that the District will have to bear substantial additional costs of distribution if project water is to be put to its most efficient use.

3. In contract negotiations representatives of the District will raise the question of providing for a reduction in water rates following full repayment of the reimbursable portion of the project cost.

The District's Position Regarding the Grizzly Valley Project

We are informed that the major portion of the service area of the proposed Grizzly Valley Project as presently contemplated by the Department of Water Resources lies outside the present boundaries of the Last Chance Creek Water District. There is some indication that land owners in the area west of the Last Chance Creek Water District will desire either to form a new district of their own or to be annexed to the Last Chance Creek District. Beyond commenting on these possibilities, the Directors of the Last Chance Creek District do not feel that

they can properly make representations concerning the major portion of the Grizzly Valley service area. The Directors are informed, however, that the Last Chance Creek District is more directly involved by the proposed Grizzly Valley Project in that we are informed that the proposed main conduit running along the northern rim of Sierra Valley would terminate within the Last Chance Creek District and would have a capacity, at its terminus, of 17 second-feet. Concerning the purchase of water from this project, the Directors can state that the Last Chance Creek Water District will enter negotiations on the basis of the price stated in Bulletin No. 59. The comments set forth above concerning the proposed Frenchman Creek Project contract apply as well here.

Dated: 26 February 1957

/s/ William E. Ryan

WILLIAM E. RYAN, President Board of Directors
Last Chance Creek Water District

COPY

P A C I F I C G A S A N D E L E C T R I C C O M P A N Y

245 Market Street

SAN FRANCISCO 6, CALIFORNIA

WALTER DREYER

e-President and Chief Engineer

March 12, 1957

Mr. Harvey O. Banks, Director
Department of Water Resources
P. O. Box 1079
Sacramento 5, California

Dear Mr. Banks:

At the joint hearing by the Department of Water Resources and the State Water Board on Bulletin 59, "Investigation of Upper Feather River Basin Development, Interim Report on Engineering, Economic and Financial Feasibility of Initial Units", on February 14, 1957, the Pacific Gas and Electric Company submitted a statement and requested additional time in which to make further comments.

Enclosed herewith are such additional comments, setting forth the Company's position with respect to water rights in greater detail, as well as its conclusions regarding certain recommendations contained in Bulletin 59. To complete the record, a copy of the Company's original statement is also included.

This opportunity to comment upon Bulletin 59 is appreciated.

Very truly yours,

/s/ Walter Dreyer

Walter Dreyer

WD ab

Encl.

cc Mr. Clair Hill, Chairman
State Water Board
(with encl.)

ADDITIONAL COMMENTS

ON DEPARTMENT OF WATER RESOURCES
PRELIMINARY EDITION OF BULLETIN NO. 59

"INVESTIGATION OF UPPER FEATHER RIVER BASIN DEVELOPMENT -
INTERIM REPORT ON ENGINEERING, ECONOMIC AND FINANCIAL
FEASIBILITY OF INITIAL UNITS"

By

PACIFIC GAS AND ELECTRIC COMPANY

The following comments supplement the statement which the Pacific Gas and Electric Company submitted before representatives of the Department of Water Resources and the State Water Board at Quincy on February 14, 1957. At that time, the Company had not had the opportunity to review Bulletin 59 and its statement was necessarily of a preliminary nature.

The statement on February 14, 1957 called attention to certain water rights which the Company holds as custodian for public service use for its power and irrigation facilities on the Feather River. A subsequent study of the planned operation of the reservoirs of the Indian Creek Recreation Project furnished to the Company by the Department shows that water would be stored adversely to Company rights in many years, including the driest years such as 1924 and 1931 and that there would be a significant reduction in the energy generated and an effect on the capacity output of the Company's Rock Creek, Cresta, Poe and Big Bend hydroelectric projects.

In order to avoid the detrimental interference with existing downstream water rights, sufficient storage should be provided and operated to carry over stored water from periods of surplus supply in order to compensate for consumptive uses and evaporation losses in periods when surplus water is not available.

There has been insufficient time since release of Bulletin 59 to review in detail the effect of the proposed reservoirs upon the Company's irrigation diversion to the Western Canal. It is known, however, that the proposed operation of these upstream reservoirs would create a detrimental effect during the early months of the irrigation season in certain years. Much of the water diverted to the Western Canal and other canal systems below Oroville is used for rice culture which requires considerable quantities of water during April and May, during which months of most years it is planned to store water in the proposed reservoirs. Consumptive uses from and operation of the proposed Grizzly Valley and Frenchman Projects would also reduce flows available for the Western Canal in many dry years unless sufficient carryover storage is provided to prevent infringement upon established downstream water rights.

The broad assumptions and methods used for economic justification in Bulletin 59 are properly a subject for review by the Legislature, but it should be noted that the detrimental effect of the planned operation of the proposed reservoirs upon existing hydroelectric development and on the proposed Oroville Power Plant should have been evaluated and charged as costs to the proposed reservoirs.

In view of the interferences with water rights cited above, the Company as well as other downstream water users would be obligated to protect their vested rights against the proposed projects unless the plan of operation is revised to eliminate such interferences. In view of possible complications in the water rights situation, the Company concurs in Recommendation No. 4 of Bulletin 59, that no construction should be undertaken until necessary water right permits have been obtained.

Legislative authorization, if granted, should apply specifically to the initial units described in Bulletin 59, as called for in Recommendation No. 1. Such authorization should be made only after opportunity for full and complete hearings before Committees of the Legislature.

As suggested by Recommendation No. 6, there should be similar opportunity for hearings on, and adoption by the Legislature of, State policies relating to cost allocation, repayment, nature and amount of non-reimbursable costs, if any, to be borne by the State taxpayers, economic justification, financing, and construction of water development projects.

In view of the above considerations, it appears that appropriation of \$1,300,000, in accordance with Recommendation No. 2, would be premature, unless made conditional upon acquisition of water right permits, specific authorization, and establishment of State policies concerning water development projects.

COPY

BOARD OF SUPERVISORS
C O U N T Y O F P L U M A S

State of California

QUINCY, CALIFORNIA

22-March-1957

Mr. Harvey O. Banks, Director
Department of Water Resources
Box 1079
Sacramento 5, California

Dear Mr. Banks:

Enclosed please find certified copy
of Resolution No. 865, adopted by the Plumas
County Board of Supervisors at their adjourned
regular meeting held on the 22nd day of March,
1957.

Sincerely,

LOIS KEHRER, County Clerk and
Ex-Officio Clerk of the Board
of Supervisors

by /s/ June Crivello
Deputy

encl - 1

WHEREAS, at the 1956 session of the Legislature of the State of California, there was appropriated the sum of \$385,000.00 for the purpose of making engineering and geological investigations for a construction program of multi-purpose water development and flood control projects in the Upper Feather River Service Area; and

WHEREAS, pursuant to said appropriation and legislative direction, the Department of Water Resources of the State of California made said investigations, and in February, 1957, published the results of such investigations in a report, described as: Bulletin No. 59; and

WHEREAS, said Bulletin No. 59 reports and determines that the Indian Creek recreation project, the Frenchman Creek project, and the Grizzly Valley project, are feasible both from an engineering and financial standpoint, and are economically justified, either jointly or individually; and

WHEREAS, there is a general state-wide interest in and current need for the benefits to be derived from the general recreational features of the foregoing projects, because of the rapidly expanding requirement for outdoor recreational opportunities in this State, and the established use of existing outdoor recreational facilities in the Upper Feather River Basin by people throughout California; and

WHEREAS, on the assumption that they will form a part of a general development of the recreation resources of the Upper Feather River Basin - one of the most attractive and accessible recreation areas in this State - the evaluation of the proposed initial units was made; and

WHEREAS, it is important in the full realization of the State's natural resources for meeting the recreational needs of an expanding population, that development of the recreational facilities of the Upper Feather River Basin be utilized; and

WHEREAS, it is the opinion of the Legislative Counsel of the Department of Water Resources, and the Department of Finance, of the State of California, that the Upper Feather River projects have already been authorized as part of the over-all Feather River project;

NOW THEREFORE, BE IT RESOLVED by the Board of Supervisors of the County of Plumas, State of California, that said Board hereby urges the Legislature of the State of California, in its 1957 Session, to establish legislation, and appropriate funds, for the full development of the Upper Feather River Service area; and

BE IT FURTHER RESOLVED that said Board vigorously endorses Bulletin No. 59, and urgently requests that sufficient and adequate funds be appropriated for the purchase of sites for design features, and for construction of the initial units, as described in said Bulletin No.59; and

BE IT FURTHER RESOLVED that additional funds be appropriated at this Session of the Legislature for further engineering, economic, and feasibility studies of the Meadow Valley-Nelson Point, Genessee, and Squaw Queen projects in the Upper Feather River Service Area, for multi-purpose development, all such projects being a unit of the Feather River project, and an initial phase of the California Water Plan; and

BE IT FURTHER RESOLVED that the Clerk of this Board shall forward copies of this Resolution to: Harvey O. Banks, Director of the Department of Water Resources - Senator Stanley Arnold - Assemblyman Pauline Davis -and Dr. Samuel Wood, of Harold F. Wise and Associates.

The foregoing Resolution was duly passed and adopted by the Board of Supervisors of the County of Plumas, State of California, at a regular adjourned meeting of said Board held on the 22nd day of March, 1957, by the following vote:

AYES: Supervisors	<u>CLOMAN, FLANAGAN, BLACKMAN,</u>
	<u>HUMPHREY and DONNENWIRTH.</u>
NOES:	<u>NONE.</u>
ABSENT:	<u>NONE.</u>

A. C. Donnenwirth
Chairman of said Board of Supervisors

ATTEST:

Seal)

Lois Kehrer
County Clerk and Ex-Officio Clerk
of said Board of Supervisors

PLUMAS COUNTY CHAMBER OF COMMERCE

RESOLUTION

Urging the Legislature, State of California, to establish legislation and to adopt policy for the full development of the Upper Feather Basin Service Area calling for the construction of five dams and reservoirs as the initial phase, found economically feasible by the Department of Water Resources, State of California, Bulletin #59.

WHEREAS, the 1956 session of the California Legislature included as Item 223.1 the following appropriation for completion of engineering and geological investigation, studies and reports, with recommendations for a construction program for multipurpose water development and flood control projects in the Upper Feather River Service Area, Division of Water Resources, Department of Public Works, \$385,000.00, and

WHEREAS, the Department of Water Resources, State of California, as a result of their investigations of the Upper Feather River Service Area did publish this report in February 1957 and is known as Bulletin #59, and

WHEREAS, this report presents the results of studies to determine the engineering feasibility, economic justification, and financial feasibility of the initial units which are; three in the Indian Creek Recreation project, the Frenchman project and the Grizzly Valley project, and

WHEREAS, these initial units described above and in accordance with paragraph 1 of the conclusions of Bulletin #59, would be both engineeringly feasible and economically justified, either jointly or individually, and

WHEREAS, because of the rapidly expanding requirement for outdoor recreational opportunities in California, and the established use of existing outdoor recreational facilities in the Upper Feather River Basin by people throughout California, there is a general state-wide interest in and current need for the benefits to be derived from the general recreational features of the foregoing projects, and

WHEREAS, evaluation of the proposed initial units as recreation assets has been made on the assumption that they will form part of a general development of the recreation resources of the Upper Feather River Basin, one of the most attractive and accessible recreation areas of the State of California, and

WHEREAS, with the full development of the recreation resources of the Upper Feather River Basin as a most important part of the State's natural resources for meeting the recreational needs of an expanding population,

NOW, THEREFORE, BE IT RESOLVED, that the Board of Directors of the Plumas County Chamber of Commerce, State of California, this 6th day of March, 1957, do hereby urge the California State Legislature, at this 1957 session, to establish legislation and appropriate funds for the full development of the Upper Feather River Service Area and do whole-heartedly endorse Bulletin #59, and do urgently request adequate funds for the purchase of sites, for design features and for construction of the initial units as described in Bulletin #59, Department of Water Resources, State of California. Also that additional funds be appropriated, at this session of the Legislature, for further engineering, economic and feasibility studies of the Meadow Valley-Nelson Point, Genesee and the Squaw Queen projects in the Upper Feather River Service Area for multi-purpose development - - all as a unit of the Feather River Project, the initial phase of the California Water Plan.

/s/ Karl Traylor
Karl Traylor, President
Plumas County Chamber of Commerce

/s/ Max Forbes
Max Forbes, Manager
Plumas County Chamber of Commerce

COPY

PLUMAS COUNTY DEPARTMENT OF AGRICULTURE

Quincy, California

March 14, 1957

Mr. Harvey O. Banks, Director
Department of Water Resources
1120 N Street
P.O. Box 1079
Sacramento 5, California

Dear Mr. Banks:

Attached is the statement of the policy of The Plumas County Water Resources Board which we submit to you as testimony of our approval of the meeting held in Quincy February 14, 1957.

We take this opportunity to thank you for your cooperation and for the understanding that the various members of the committee showed the people in Plumas County.

Yours very truly,

/s/ E. B. Bond
E.B.BOND, Secretary
Plumas County Water Resources Board

THE PLUMAS COUNTY
WATER RESOURCES BOARD

Quincy, California

February 28, 1957

Mr. Clair Donnerwirth, Chairman
Board of Supervisors
Plumas County
Quincy, California

Dear Mr. Donnerwirth:

In reviewing statements that were made at a joint public hearing of the State Water Board and the Department of Water Resources, held in Quincy on February 14, 1957, the Plumas County Water Resources Board would like to emphasize their policy with regard to the Upper Feather River Basin development on the following points:

1. We have recommended the adoption of Bulletin #59, titled, Investigation of the Upper Feather River Basin Development and whole-heartedly concur with Mr. Donnerwirth's statement made in behalf of the Plumas County Board of Supervisors at the above joint meeting.
2. By resolution we, The Plumas County Water Resources Board, have urged that monies be made available at the present session of the Legislature in amounts sufficient for the acquisition of sites for design features, and for construction of the initial units, as described in said Bulletin No. 59, in the amount of \$1,300,000.00 for the development of the five authorized projects, namely: Antelope Valley Reservoir, Dixie Refuge Reservoir, Abbey Bridge Reservoir, Grizzly Valley Reservoir and Frenchman Reservoir.
3. That additional monies be made available for further engineering studies pertinent to the full development of the Upper Feather Basin as set forth in the recommendations dated April 1955, titled Northeastern Counties Investigation Report on Upper Feather River Service Area, page 293, recommendation No. 4 as follows: "That the following projects on the North and Middle Forks of the Feather River be given further study as features of The California Water Plan: Squaw Queen Project, Indian Falls Project, Meadow Valley Project and Sheep Camp Project."

We, therefore, present for your endorsement the above recommendations and ask that, if this meets with your approval, the Chairman of said Board of Supervisors affix his signature hereto.

Yours very truly,

/s/ E.B. Bond
E.B. BOND, Secretary
Plumas County Water Resources Board

/s/ Clair Donnerwirth
Clair Donnerwirth, Chairman
Plumas County Board of Supervisors

COPY

CITY OF PORTOLA, PORTOLA, CALIFORNIA

March 13, 1957

Mr. Harvey O. Banks
Director of Water Resources
P. O. Box 1079
Sacramento 5, California

Dear Sir:

re: Bulletin No. 59

I am writing to state the position of the City of Portola with respect to the recommendations and assumptions made in Bulletin No. 59.

The City concurs in the assumption of Bulletin 59 that if the State of California is to construct the Oroville Dam, it is a proper function for the State to build in connection therewith economically feasible up-stream projects leading to the fully integrated development of the Feather River Basin. The City also believes that the public interest requires that the State should assume responsibility for costs attributable to lands, easements, and rights of way. We believe that the Legislature should set policies of cost allocation under which project construction costs would be divided between recreation, flood control, and water supply purposes. Costs attributable to recreation and flood control would be expended in furtherance of a state-wide interest and should not be reimbursed. Costs attributable to water supply (either irrigation or municipal) should be reimbursed by the water users.

The City of Portola is particularly interested in the proposed Frenchman and Grizzly Projects. Concerning both of these projects we suggest that Bulletin No. 59 has not sufficiently emphasized the local flood control benefits which will be produced. The City of Portola has within recent years sustained substantial damage as a result of high water in the Middle Fork of the Feather River. We believe that these two projects would go a long ways toward protecting this area from further damage from flooding.

It is noted that alternative recommendations have been made with regard to the Grizzly Project. Bulletin No. 59 recommends that if prospective users of irrigation water from Grizzly Creek

indicate willingness to pay for such water at appropriate prices, the project should be built in modified form for recreation and stream regulation alone. We agree that the Grizzly Creek Project is feasible on this alternative basis even if it is not to produce irrigation water. However, we hope that consideration should be given toward planning the Grizzly Creek Project in such a way as to make available a supply of municipal water for the City of Portola. The City Council is sufficiently interested in this project to request that studies be made of the cost of providing municipal water from this source. If such information is made available the City Council will desire to discuss the possibilities of purchase of Grizzly Creek Water by the City.

Sincerely yours,

/s/ Ira C. Baldwin
IRA C. BALDWIN
Mayor
City of Portola

COPY

R I C H V A L E I R R I G A T I O N D I S T R I C T
RICHVALE, CALIFORNIA

March 15, 1957

Mr. Harvey O. Banks
Director of the Department
of Water Resources
1120 N. Street
Sacramento, California

Dear Sir:

The Richvale Irrigation District submits the following comments with respect to the plan of development proposed by Bulletin 59 for the Upper Feather River Basin.

The interest of the Richvale Irrigation District arises, of course, out of the fact that it is a present user of the flow of the Feather River and has existing water rights developed at the expense of the District and for many years applied to beneficial use which must be protected, and in addition has proposed a development of the Middle Fork of the Feather River that will provide additional water needed by the District and others and also provide for maximum development of the power resources of the Middle Fork.

The plan of development proposed by Richvale Irrigation District is referred to starting at page 33 of Bulletin 59, and as you know the Federal Power Commission recently granted a preliminary permit for the development of the project and in doing so denied conflicting applications for the development of this fork of the river. The Federal Power Commission by its permit found that the plan of the Richvale Irrigation District provides comprehensive development of the Middle Fork of the Feather River.

The proposed development as outlined in Bulletin 59 is in large measure not in conflict with the plan proposed by the Richvale Irrigation District. However, in certain respects there is a definite conflict.

It is in connection with the foregoing that the following comments and suggestions are made respecting Bulletin 59.

1. The Richvale Irrigation District, together with other users of water from the systems in Butte County known as the Western Canal System and Sutter Butte

Canal System have vested rights to use and do use substantially all the natural flow of the Feather River during the irrigation season in most years. In fact the natural flow is inadequate to supply the needs of the district and in dry years this shortage starts early in the irrigation season.

Manifestly, the District as trustee for its landowners is obligated to protect their interests and therefore wishes to point out that in the operation of the Upper River Development proposed by Bulletin 59 it is essential that the natural flow of the Feather River must be allowed to continue as it would in nature during the irrigation season. We believe that Bulletin 59 does not take this requirement into consideration in evaluating the economics and the desirability of the proposed development.

2. Three of the proposed reservoirs are tributary to the North Fork of the Feather River and as to those reservoirs the Richvale Irrigation District has no criticism to make provided they are operated in such a manner as to not conflict with the existing water rights of the District.

3. Frenchman Reservoir is on a tributary of the Middle Fork of the Feather and would affect the proposed development of the Upper Reaches of the Middle Fork contemplated by the Richvale Irrigation District.

The Richvale Irrigation District held water applications #16340 and 16341 to water of Little Last Chance Creek for storage in a reservoir at approximately the same point proposed in Bulletin 59 for Frenchman Reservoir. However, it was realized that the water from Little Last Chance Creek would normally flow through Sierra Valley and logically should be used for the development of that area and consequently did not press those applications.

The Richvale Irrigation District has decided not to proceed with its original plan of developing Little Last Chance Creek and has no additional comment to make on the proposed development of that creek as set forth in Bulletin 59.

4. The fifth reservoir proposed in Bulletin 59 is Grizzley Valley Reservoir on Big Grizzley Creek. The Richvale Irrigation District plan also proposes a reservoir at that point, and the District has prior water filings for that purpose.

Bulletin 59 proposes an alternative use of the water of Grizzley Creek. One use is to supplement the water available from Little Last Chance Creek to irrigate Sierra Valley, and the other use is for stream flow maintenance below the reservoir. The two uses are conflicting in view of the fact that the water available is not adequate to provide for both.

First as to the use of the water for irrigation in Sierra Valley. The report indicates that the cost of water at the main canal would be \$4.00 per acre foot, manifestly the cost of water delivered to the land would be much greater. We believe that the price mentioned is prohibitive and consequently, the proposal made in Bulletin 59 would not provide the irrigation desired. Furthermore, the use of water for that purpose would conflict with the vested rights of the Richvale Irrigation District, as pointed out in paragraph 1, and also with its proposed plan of development under prior applications. The net result is that the proposed Bulletin 59 development would not provide the benefits contemplated and would prohibit other economic development that could be made to the benefit of both Sierra Valley and Richvale Irrigation District.

The proposed development of the Richvale Irrigation District is economically sound and can be financed from power revenues. Thus, the Grizzley Valley Reservoir would and could be built without any expense to the State of California. During the period of retirement of bonds water from Grizzley Valley Reservoir would of necessity be allocated to producing power revenues for repayment of bonds and during this period under our plans, the water needs of Sierra Valley would be satisfied from Frenchman Reservoir. However, after the retirement of the bonds used to construct the Richvale Project, and such period could not be longer than fifty years, and would probably be less, the Richvale Irrigation District would be willing to agree that whatever water is produced by the Grizzley Valley Reservoir could be available at the Reservoir to the extent needed by Sierra Valley at a cost equal to maintenance and

operations charges of the Reservoir. This would provide water at a price the lands could afford to pay.

5. The other use proposed by Bulletin 59 of water from Grizzley Valley Reservoir is for stream flow maintenance. The Richvale Irrigation District plan of development would provide comparable benefits and the Richvale Irrigation District would be willing to agree to a reasonable plan of operation that would provide stream flow maintenance. The advantage of the Richvale plan is that this benefit would be provided without cost to the State and with great benefit in the form of power production and availability of water for irrigation.

6. The Bulletin 59 proposal is largely justified by setting up a new principle that recreational benefits are a State obligation and non-reimbursable. The report points out that this is a question of policy that must be determined by the legislature. We wish to point out that the Richvale Proposal provides much greater recreational benefits in that reservoirs would also be constructed at Clio and Nelson point. If funds for recreational benefits are to be allocated to the Bulletin 59 proposal they should also be allocated by the State as non-reimbursable donations to the Richvale Project.

Very truly yours,

RICHVALE IRRIGATION DISTRICT

By /s/ Alvin L. Harry
Secretary

STATEMENT OF SIERRA COUNTY FILED WITH THE
DEPARTMENT OF WATER RESOURCES AND THE STATE WATER BOARD

At the joint hearing held in Quincy on February 14, 1957, by the Department of Water Resources and the State Water Board, a brief oral statement was made on behalf of Sierra County by Winslow Christian, the District Attorney of Sierra County. Following that statement, leave was given for the County to file a statement in writing setting forth in further detail its views upon Bulletin No. 59. The statement of policy set forth below represents the views of the Water Resources Board and the Board of Supervisors of Sierra County.

Bulletin No. 59 recommends the construction by the State of California of five water conservation projects in the upper watershed of the Feather River. None of these five projects would, according to the proposals outlined in the bulletin, afford any direct benefit to Sierra County. However, the basic assumptions underlying the bulletin and certain of the recommendations contained therein relate to basic policy which will affect Sierra County when consideration is given at a future time to similar small projects more directly affecting this County which have been given preliminary consideration in the Division of Water Resources' Northeastern Counties Investigation: Report on Upper Feather River Service Area.

Comment on the Concept of Basin Development

Bulletin No. 59 is basically a proposal that the State of California is properly concerned with integrated development of the Water Resources of the Feather River Basin, including both the export project at the Oroville Dam and smaller works in the upper basin. Sierra County concurs in that assumption of policy for the following reasons:

1. The proposed upstream projects would go a long ways toward meeting the State's increased need for public recreational facilities. The meeting of these needs is a proper function of the State of California.

2. The needs of the upstream areas are similar to those of the areas in Central and Southern California which will directly benefit from the export project at the Oroville Dam. If it be assumed, therefore, that the Oroville Dam is a proper State project, it follows that less expensive projects in the upper watershed are also a proper State function where they can be justified by a comparison of cost and public benefit.

Comment on Proposed Cost Allocation

The County of Sierra agrees that basic policy regarding cost allocation needs to be established by the Legislature and believes that the assumptions of Bulletin No. 59 in this regard are sound.

The County in particular agrees that the State of California should assume the costs of providing for lands, easements, and rights of way, and of relocating public utilities; that the costs apportioned to recreation and flood control should not be reimbursable by water users; and that the costs apportioned to irrigation should be reimbursed by the water users with a reasonable rate of interest.

Comment on Proposed Grizzly Valley Project

As was indicated above, Bulletin No. 59 does not propose any direct benefit to Sierra County from any of the five projects outlined. However, we note that the feasibility of the Grizzly Valley Project as an irrigation works depends on the willingness of land owners in the Northern portion of Sierra Valley to pay an appropriate price for irrigation water. The bulletin sets forth an alternative proposal to the effect that if there is no effective demand for irrigation water from this project, the irrigation features be deleted and the project be built for its recreation and stream flow benefits alone.

In the event that landowners in Plumas County should in fact be unwilling to purchase water from this project, Sierra County requests that study be made of the cost of delivering such water from the Grizzly Valley Project to the portion of Sierra Valley which lies within Sierra County. The purpose of this request is to allow potential water users in Sierra County to determine whether the cost of Grizzly Valley water would be within their ability to pay.

Conclusion

In conclusion, Sierra County, acting through its Water Resources Board and Board of Supervisors, desires to express its approbation of the work which has been done in preparation of Bulletin No. 59 and to request that similar work be completed as soon as possible as to other projects mentioned in the Report on Upper Feather River Service Area which would directly benefit Sierra County.

DATED: March 14, 1957.

BY DIRECTION OF THE SIERRA COUNTY
BOARD OF SUPERVISORS

/s/ Louis Genasci

LOUIS GENASCI, Chairman, Water
Resources Board, Sierra County

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